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"CONSERVATION OF WILDLIFE THROUGH EDUCATION"

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THE BURRO DEER

Odocoileus hemionus eremicus [1]

By William M. Longhurst and John E. Chattin
University of California Museum of Vertebrate Zoology

Of the six kinds of black-tailed deer found within California, the burro deer is probably the least known. It was originally formally named by Mearns as *Dorcelaphus hemionus eremicus* in 1897 from a specimen taken in Sonora, Mexico, but has remained exceedingly rare in zoological collections. Because of the isolated nature of its habitat in the Colorado River region, it is seldom sought by sportsmen and relatively few burro deer are killed in the open season. Until recently the scarcity of available material has prevented a thorough comparison of this deer with surrounding races with which there is chance of intergradation. Early in January, 1940, we were fortunate in securing three additional specimens of this deer from the Arroyo Seco, Imperial County, about midway between Blythe and Winterhaven. Study of this and other material already in the California Museum of Vertebrate Zoology gives a better understanding of how *eremicus* differs from surrounding races.

While we were in the Colorado River region the habitat and habits of the burro deer were noted. At this season, early in January, all the deer seemed to be in the hills well back from the river. Residents told us that this was normal; they said that the deer spent the dry season (the summer) in the dense riparian association of the river bottom, but if there was sufficient rain in the winter to bring up green feed and to fill the water holes in the neighboring hills, the deer moved there and remained as long as the feed lasted. McLean (California Fish and Game, 16:119-120, 1930) also mentions this seasonal "migration." Eleven deer were seen in the foothills of the Palo Verde and Chuckwalla mountains along the northeast side of the Arroyo Seco. All were in an area of approximately sixteen square miles, but feed and water were especially plentiful in this particular area and it is doubtful if deer were present in equal numbers throughout the entire region. The desert washes lined with palo verde and ironwood trees and creosote bushes seemed to be the favored habitat of the burro deer. At this time their principal forage, as determined by following their tracks and noting kinds of plants browsed and by examining their droppings, was the perennial grass, *Hilaria rigida,* which grew along the washes.

Even though it was the middle of January, a number of facts indicated that these deer were still in the rut: They were banded together, eight were seen in one band and three in another; the necks of the bucks were much enlarged; and the tarsal glands of all three

[1] Contribution from the California Museum of Vertebrate Zoology. Submitted for publication, June, 1940. All photographs and drawings by William M. Longhurst.

FIG. 1. Above, dorsal view of burro deer taken in the Arroyo Seco, Imperial County, California, showing size of rump patch. Middle, anterior view of burro deer taken at same locality showing light coloration about head and on legs. Below, skulls of the above specimens showing relative sizes of antlers as compared with a fifteen-inch ruler.

obtained were secreting heavily. When these animals were skinned, little if any subcutaneous fat was found and there was likewise but little fat in their abdominal cavities. This lean condition may have resulted from the rather scanty feed upon which they were subsisting or to the excessive activity during the rutting season. The uterus of the female showed no evidence that conception had as yet taken place although there were a number of bruises about her back and rump such as bucks might have made in attempting to mate with her.

In life, two outstanding features were at once apparent which would serve to distinguish the burro deer from northern races: They appeared noticeably short legged and they were remarkably light colored, particularly about the head and underparts.

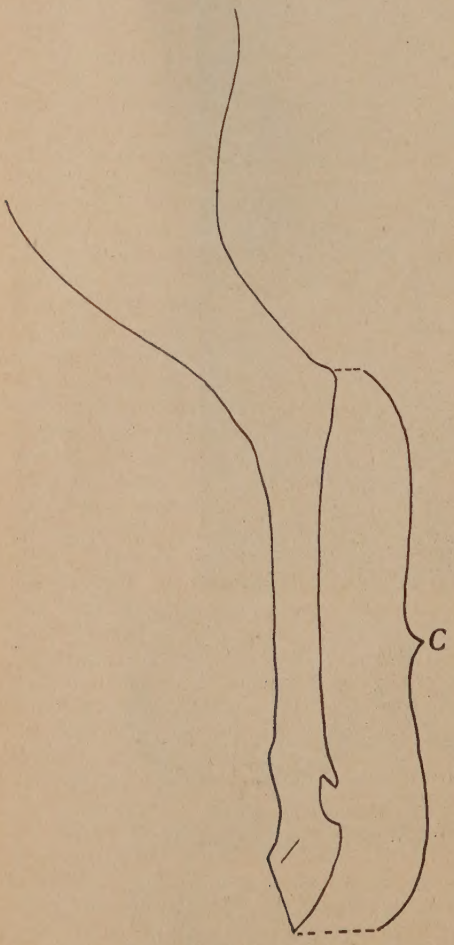

FIG. 2. Diagram of hind leg showing how measurement of the hind foot is taken; C = measurement of hind foot.

The best comparison of *O. h. eremicus* with surrounding races is that given by Cowan (California Fish and Game, 22:236-237, 1936). He had only the skulls of four adult males from the Colorado River region in California and Arizona and the skin and skull of the type from Sonora, Mexico; thus his data were at best incomplete and he had to rely on Stephens (California Mammals. West Coast Publishing Co., San Diego, 50-51, 1906) for external body measurements.

Only specimens contained in the Museum of Vertebrate Zoology have been considered in the following comparisons which are made with regard to color, external body measurements and cranial measurements. For comparisons of cranial and external body measurements only adults were used, and for comparisons of coloration only adults in winter pelage were used. This was because all of the skulls of *eremicus* available were adults and likewise all of the skins of *eremicus* were in winter pelage. All cranial and external body measurements of the specimens of *eremicus* have been included, but for other races only those measure-

ments which show average differences of 5 mm. or more from *eremicus* have been included. Specimens which had a full dentition were considered to be adult. Cranial measurements are taken in millimeters and in the manner described by Cowan (*op. cit.*, 1936:193). External measurements taken in the field may be defined as follows:

(a) Total length—distance from tip of nose to tip of tail vertebra.

(b) Length of tail—distance from base of tail to tip of tail vertebra.

(c) Hind foot—distance from heel to tip of hoof (see Fig. 2).

(d) Ear—distance from notch to tip, exclusive of hairs.

Cowan (1936:237) states that only *O. h. fuliginatus* and *O. h. canus* (=*crooki*) have ranges overlapping that of *eremicus* and that although no intergrades have been found between *eremicus* and either of these races, they are expectable. The term intergrade is used here to designate an individual from an area where the ranges of two races of a single species overlap and where the two races or subspecies interbreed freely and produce a population intermediate in character; individuals of this population may exhibit characters of either or both races and usually of both. The term intergrade is used in contrast to the term hybrid which is usually considered to be an individual with parents of two different species. In nature, however, species are distinguished by the fact that even though their ranges may overlap, the two kinds do not crossbreed. Nevertheless, because the northern limits of the range of *eremicus* are so imperfectly known, as are likewise the eastern limits of the range of *californicus*, the southern limits of the range of *inyoensis* and the southern limits of the range of *hemionus* in Nevada, it is possible that intergradation occurs between *eremicus* and each of these other races. In this regard W. C. Russell of the Museum of Vertebrate Zoology (MS) reports seeing a small deer on Kingston Peak in northeastern San Bernardino County on June 5, 1939. This locality lies west of the known range of *hemionus* and east of the range of *inyoensis* and shows that there are deer in the territory where intergradation would be expected to occur but from which no study specimens are available.

Comparisons

Male burro deer (*O. h. eremicus*) differ from male Rocky Mountain mule deer (*O. h. hemionus*) as follows: General color lighter; dorsal surface grayish yellow rather than grayish or dusky brown; rump patch more restricted; brisket lighter brown; hairs scattered along dorsal surface of tail brown rather than pure white; brow patch lighter brown; spots about rhinarium lighter brown; median chin spot not as well developed; hind foot shorter; basilar length of Hensel greater; nasal length less; orbital width less; zygomatic width less; mastoidal width less; upper molar series longer; and diastema longer. Female *eremicus* differ from female *hemionus* as above except that there are smaller differences in orbital, zygomatic, and mastoidal widths, but female *eremicus* have greater maxillary width and palatal breadth.

TABLE I

Comparison of *Odocoileus hemionus eremicus* with Other Races
Measurements are in millimeters; 25 millimeters equivalent to approximately one inch

	Total length	Length of tail	Hind foot	Ear height from notch (Cr.—crown)	Metatarsal gland	Basilar length	Nasal length	Greatest width of nasals	Least width of nasals	Orbital width	Zygomatic width	Mastoid width	Maxillary width	Palatal breadth	Post-palatal breadth	Width of external nares	Length of external nares	Upper molar series	Lower molar series	Diastema
O. h. eremicus, 2♂ from California	1660–1775	165–183	460–465	214–224	132–147															
1♀ from California	1575	160	440	197	162	253	84	34	19	78	110	74	94	53	31	38	73	80	91	69
6♂ from California and Arizona						(4) 276 (273–283)	85 (77–100)	35 (31–44)	27 (23–29)	83 (79–85)	118 (112–124)	86 (79–93)	97 (91–101)	(5) 53 (52–55)	(5) 32 (29–36)	(4) 41 (39–43)	(4) 80 (79–81)	84 (81–88)	(5) 93 (90–95)	(5) 76 (67–81)
O. h. hemionus, 5♂ from Nevada						272 (269–285)	92 (85–100)			88 (82–92)	123 (116–128)	91 (88–95)						82 (80–86)		(3) 73 (72–75)
1♂ from Washington	1751	172	515	210	150															
3♀ from Nevada						242 (238–246)	74 (66–87)			76 (74–78)	112 (100–118)	73 (68–76)	87 (86–89)	46 (44–51)				75 (74–77)		64 (63–66)
1♀ from California	1530	160		(Cr.) 228	110															
O. h. californicus, 2♂ from California	1600–1710	160–190	440–470	190–200																

6♂ from California						245 (239–253)										36 (32–41)	69 (64–79)	70 (67–77)	78 (74–84)	68 (62–72)
O. h. inyoensis, 2♂ from California	1740	180	485	210	94													78–79	89–90	61–66
O. h. fuliginatus, 2♂ from California and Mexico						(1) 225	71–66			73–75	101–102	70	81–82	41–44	26–28	30–31	(1) 64	78–80	84–89	54–55
2♀ from California and Mexico	(1) 1470	(1) 170	(1) 420	(1, Cr.) 220		225–242	67–82			71–79	101–104	67–71	85–87	46–47	28–29	30–36	61–71	73–74	83–87	55
O. h. crooki 3♂ from New Mexico						259 (253–263)	80 (78–82)									34 (32–36)	71 (69–72)			68 (66–70)

Male *O. h. eremicus* differ from male California mule deer (*O. h. californicus*) as follows: General color lighter; no definite black dorsal stripe; rump patch larger; dorsal side of tail has only scattering brown hairs rather than a definite black stripe; spots about rhinarium lighter; brow patch lighter brown; no black median chin spot; brisket lighter brown; total length less; hind foot longer; ear from notch longer; basilar length of Hensel greater; width of external nares greater; length of external nares greater; upper molar series longer; lower molar series longer; and diastema longer.

Male *O. h. eremicus* differ from male Inyo mule deer (*O. h. inyoensis*) as follows: Generally lighter colored; dorsal area grayish yellow rather than yellow-brown; rump patch larger; tail with only a few scattering brown hairs on dorsal surface rather than with a complete or incomplete black stripe; brow patch lighter brown; rostrum gray rather than buff; spots about rhinarium lighter brown; no median black chin spot; light area of inguinal region not extending anterior to umbilicus; tail shorter; hind foot shorter; ear from notch longer; metatarsal gland longer; upper molar series longer; and diastema longer.

Male *O. h. eremicus* differ from male southern mule deer (*O. h. fuliginatus*) as follows: General color lighter; no black dorsal stripe; rump patch larger; tail with only scattering brown hairs on dorsal surface rather than with black dorsal stripe; brow patch lighter brown; rostrum light gray-brown rather than buff-brown; brisket lighter brown; basilar length of Hensel greater; nasal length greater; orbital width greater; zygomatic width greater; mastoidal width greater; maxillary width greater; palatal breadth greater; post-palatal width greater; width of external nares greater; length of external nares greater; upper molar series longer; lower molar series longer; and diastema longer. No adult male specimens of *fuliginatus* were found with external body measurements recorded. Female *eremicus* differ from female *fuliginatus* in cranial measurements as do the males except that there is less difference in nasal length, orbital width, and post-palatal width. As shown by external measurements, female *eremicus* have greater tail length and longer hind foot and ear measured from crown.

Male *O. h. eremicus* differ from male Crook mule deer (*O. h. crooki*) as follows: General color browner; spots about base of rhinarium lighter brown; tail with scattering brown hairs on dorsal surface rather than pure white [only one skin of *crooki* for comparison, Cowan (1936:207) states that *canus* (=*crooki*) frequently has a dark dorsal stripe]; basilar length of Hensel greater; mastoidal width greater; width of external nares greater; length of external nares greater; and diastema longer.

To learn the reasons for differences in the color of the dorsal region between the various races, a study of the coloration of individual hairs was made. For comparison, hairs were plucked from the mid-dorsal line approximately one foot anterior to the base of the tail in adult specimens in full winter pelage. The coat color of the dorsal region can be explained on the basis of the length of the black tips of the hairs, the color and length of the subterminal band, and the color and

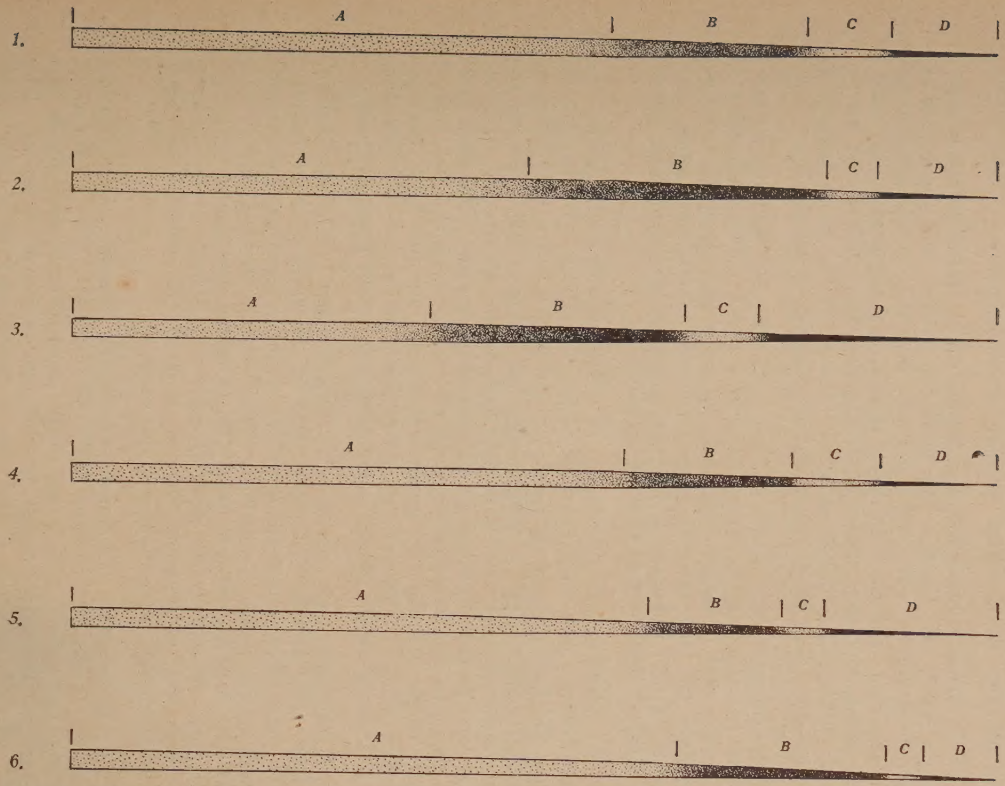

FIG. 3. Diagrams of hair of six races of black-tailed deer. Hairs are taken from adult specimens in full winter pelage at a point one foot anterior to the base of the tail along the mid-dorsal line. (1) *O. h. eremicus,* (2) *O. h. hemionus,* (3) *O. h. californicus,* (4) *O. h. inyoensis,* (5) *O. h. juliginatus,* (6) *O. h. crooki.*

length of the band immediately proximal to the subterminal band. Capitalized color terms have been taken from Ridgway (Color standards and color nomenclature. Washington, D. C., 1912).

On each hair four bands have been compared (see Fig. 3): (A) the basal band; (B) the next distal band; (C) the subterminal band; (D) the tip. Comparisons have been made in daylight coming through an open north-facing window on a clear day.

O. h. eremicus: (A) near (*a*) Avellaneous; (B) Mummy Brown; (C) Light Buff; (D) Black. The black tip is short and the subterminal band is relatively wide, but band (B) proximal to the subterminal band is also short and the total effect is that of a plumbeous gray background which is lent a light buff color by the subterminal bands. The wide subterminal bands show up because of the short black tips and because the long basal bands are not masked by band (B).

O. h. hemionus: (A) Buffy Brown; (B) near (*n*) Mummy Brown; (C) near (*e*) Light Ochraceous-Buff; (D) Black. The total color is much darker and a deeper buff than in *eremicus* principally because of the long tip, the shorter deeper colored subterminal band, and because band (B) is longer and darker masking the basal color which also is slightly darker than that of *eremicus.*

O. h. californicus: (A) near (*a*) Avellaneous; (B) near (*n*) Mummy Brown; (C) near (*e*) Pale Ochraceous-Buff; (D) Black. In this race the hair has a long black tip, fully two and a half times as long as in *eremicus,* and a subterminal band three-fourths the length of that in *eremicus,* but of a darker buff color. Band (B) is about twice as long as that in *eremicus* and is darker brown. The dark mid-dorsal stripe in this race results primarily from the long black tips of the hairs there, but the (B) bands which are long and dark, enhance the darker effect. Although the subterminal bands are shorter than those of *eremicus* their darker color gives a browner general shade.

O. h. inyoensis: (A) Drab; (B) Warm Sepia; (C) Light Ochraceous-Buff; (D) Black. The black tips of the hairs of *inyoensis* and likewise the subterminal bands are about equal in length to corresponding bands on the hairs of *eremicus.* The subterminal band, however, is a much darker buff color and band (B) is darker and longer than that of *eremicus.* Therefore the general color of the back of *inyoensis* is darker than that of *eremicus* because of band (B) and the buff cast given by the subterminal bands is also darker.

O. h. fuliginatus: (A) near (*h*) Buffy Brown; (B) Mummy Brown; (C) Light Ochraceous-Buff; (D) Black. Like *californicus, fuliginatus* has a dark mid-dorsal stripe caused by the long black tips of the hairs. These tips are fully twice as long as in *eremicus.* The general color of the whole dorsal area is darker and has a deeper buff cast than is found in *eremicus* because band (B) is darker and the subterminal band, while only about half the length of that of *eremicus,* is more deeply buff colored.

O. h. crooki: (A) Ecru-Drab; (B) near (16′) Mummy Brown; (C) Pale Ochraceous-Buff; (D) Black. The distinctly gray color of

crooki results from the shortness of the black tips of its hairs which are scarcely half the length of those of *eremicus* and the short but exceedingly light-colored subterminal bands. Because the black tips of the hairs are so short, the light subterminal bands show up on the surface in contrast to the dark background furnished by the (B) bands which are longer and darker than in *eremicus* giving a distinctly gray total effect.

Specimens Examined. Total number, 46, as follows:

O. h. eremicus

California:

Riverside County: 25 mi. S Blythe, 1.
Imperial County: Palo Verde, 2; Arroyo Seco, 5½ mi. N Midway Well, 3.

Arizona:

Colorado River opposite Blythe, Riverside County (California), 1.

O. h. hemionus

Washington:

Columbia County: Stayawhile Spring, 1.

California:

Siskiyou County: Antelope Valley, 3.
Sierra County: 4 mi. E Sierraville, 1.
Placer County: Tahoe City, 1.
Mono County: Coleville, 1.

Nevada:

Nye County: Barley Cr., Monitor Range, 2; Toquima Peak, Toquima Range 1; Greenmonster Canyon, Monitor Range, 1; Granite Range near Nyala, 2; Breen Cr., Kawich Range, 1.
Lincoln County: Pahranagat Valley, 1.

O. h. californicus

California:

Mariposa County: Near Mirror Lake, Yosemite Valley, 1.
Fresno County: Head of Bear Cr., 1.
Kern County: Kelso Valley, 1.
Santa Barbara County: Figueroa Mt., 1; Cachuma Canyon, 1; Zaca Peak, 1.

O. h. inyoensis

California:

Inyo County: 10 mi. W Big Pine, 2.

O. h. fuliginatus

California:

Riverside County: Tahquitz Valley, 1.
San Diego County: 6 mi. W Fallbrook, 2.
Barona Ranch, 30 mi. E San Diego, 1.

Lower California, Mexico:

Sierra San Pedro Martir. Vallecitos, 1; Corona, 1; La Grulla Trail, 12 mi. above San Jose, 1.

O. h. crooki

New Mexico:

Bernalillo County: Hell Canyon, Manzano Mts., 1.
Socorro County: 15 mi. W Magdalena, 1.
Otero County: 23 mi. SE Alamogordo, 1.

Summary

Additional specimens of the burro deer, *O. h. eremicus,* have made possible a more complete comparison with surrounding races because since its original description, by Mearns in 1897, it has been exceedingly rare in zoological collections. In California these deer occupy the dense riparian association along the Colorado River in the dry season, but when winter rains bring up green feed and fill water holes in the surrounding desert ranges, they migrate there and remain as long as the feed and water last. When observed in the early part of January, 1940, they appeared still to be in the rut. In life they may be distinguished from northern races by their relatively short legs and light coloration. Because the southern limits of the ranges of northern races and the northern limits of the range of *eremicus* are poorly known it is possible that intergradation may occur with the northern races. The burro deer can be distinguished from surrounding races on the basis of cranial measurements, external body measurements and coloration.

TRENDS IN CALIFORNIA'S GAME KILL 1935-1938 [1]

By J. S. Hunter and Donald H. Fry, Jr.
California Division of Fish and Game

The previous issue of "California Fish and Game" [2] contained an article on game kill statistics, which explained the methods used by the California Division of Fish and Game in gathering and compiling game figures and which also presented maps showing the proportion of game killed in each county of the State. This paper supplements the earlier one by giving the trend in the kill of each species (except deer) and by showing where the hunters from each of the two largest metropolitan areas shoot their game.

For the benefit of those who have not read the first article, we will give a brief review of the methods used in gathering game statistics. Figures on deer are obtained by requiring hunters to report each deer they kill at the time they shoot it. In addition to this, hunters are requested to fill out game kill questionnaires when they apply for hunting licenses. About one-quarter of them do. From these questionnaires, we are able to calculate the relative kills from county to county and season to season, but we can not calculate the actual total kill for any species. A special questionnaire was mailed to 23,000 hunters at the close of the 1938 season. From this, we were able to calculate the total 1938 kill of each species by multiplying its reported kill by a factor which made the reported deer kill equal the actual deer kill. This method could not be used with the license application questionnaires because on these blanks hunters recorded deer far better than they did any other species. Having 1938 totals and the relative season-by-season kills, it was an easy matter to calculate the totals for other seasons.

The charts showing the game kill trends give only the game killed from year to year. They do not attempt to show changes in the relative abundance of the game. With resident game, such as quail, pheasants [3] and rabbits, there is in all probability a very marked correlation between abundance and kill in any given area. If quail suddenly become more abundant in Kern County, more quail will be killed in Kern, and so on. This can not be trusted to always hold true. For example, hunters may "discover" a new area and the game kill may rise abruptly, whereas that very increase in kill is causing a marked decrease in abundance.

A knowledge of the game kill from season to season is essential to the best administering of this natural resource, but it should be borne in mind that the kill, by itself, is not a reliable index of abun-

[1] Submitted for publication, November, 1940.

[2] Vol. 26, No. 4, October, 1940.

[3] Pheasants are an imported species, but they are resident in the area where found, *i.e.*, they are not highly migratory.

dance. This is even more true of migratory game than of resident game. An early cold snap which sends the birds into California will do far more to produce a good duck hunting season than would a marked increase in the total duck population accompanied by a warm fall, which did not start the birds south till the California season was nearly over.

Movements of Hunters from the Major Metropolitan Counties

Six maps, figures 12 to 17, were prepared to give an idea of where the hunters from the two largest metropolitan areas go for their hunting. Kills of San Francisco and Alameda county hunters are combined to represent the San Francisco Bay area, whereas kills of Los Angeles County hunters are kept separate.

Maps such as these can be used to determine where to spend a hunter's license money so as to do that hunter the most good. For example, San Francisco County is not a place which can possibly have good hunting. Where then should the San Francisco hunter's money be spent so that it will do him some real good? Similarly, Los Angeles and Alameda counties do have some hunting territory, but not enough to take care of their large hunting populations. Here, it is probable that some of the hunter's license money could best be spent in his own county, but not all of it.

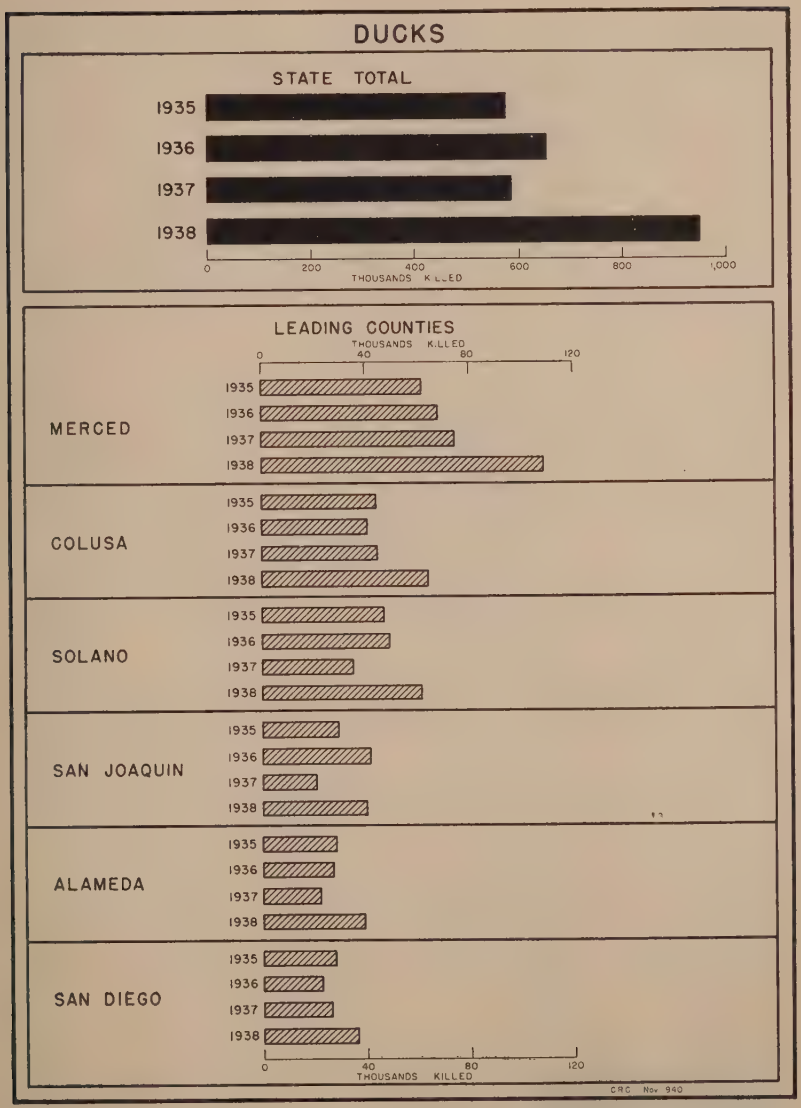

FIG. 4. The success of the duck season in California depends greatly on climatic conditions. If duck weather comes within the open season, there is good hunting, otherwise there is not.

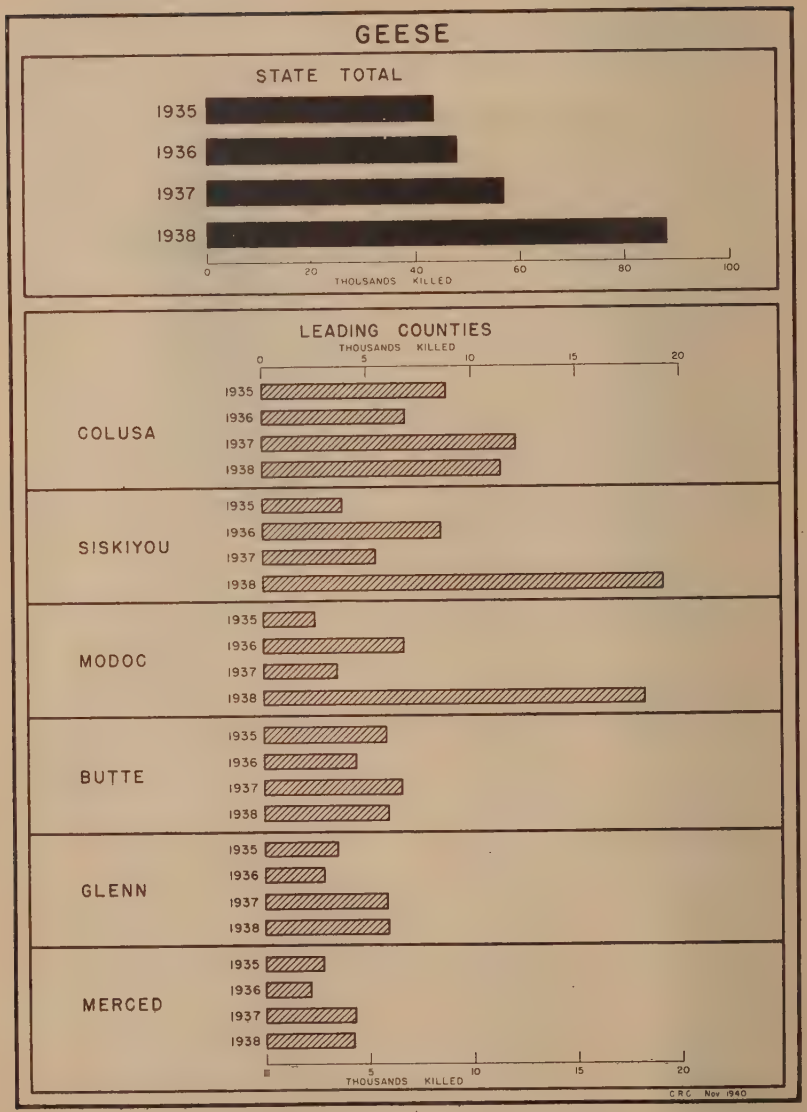

FIG. 5. The most obvious feature of this chart is the heavy kill in Siskiyou and Modoc counties in 1938. The 1938 season was early (October 15 to November 28). The birds remained in these northern counties and there was good shooting through the entire season.

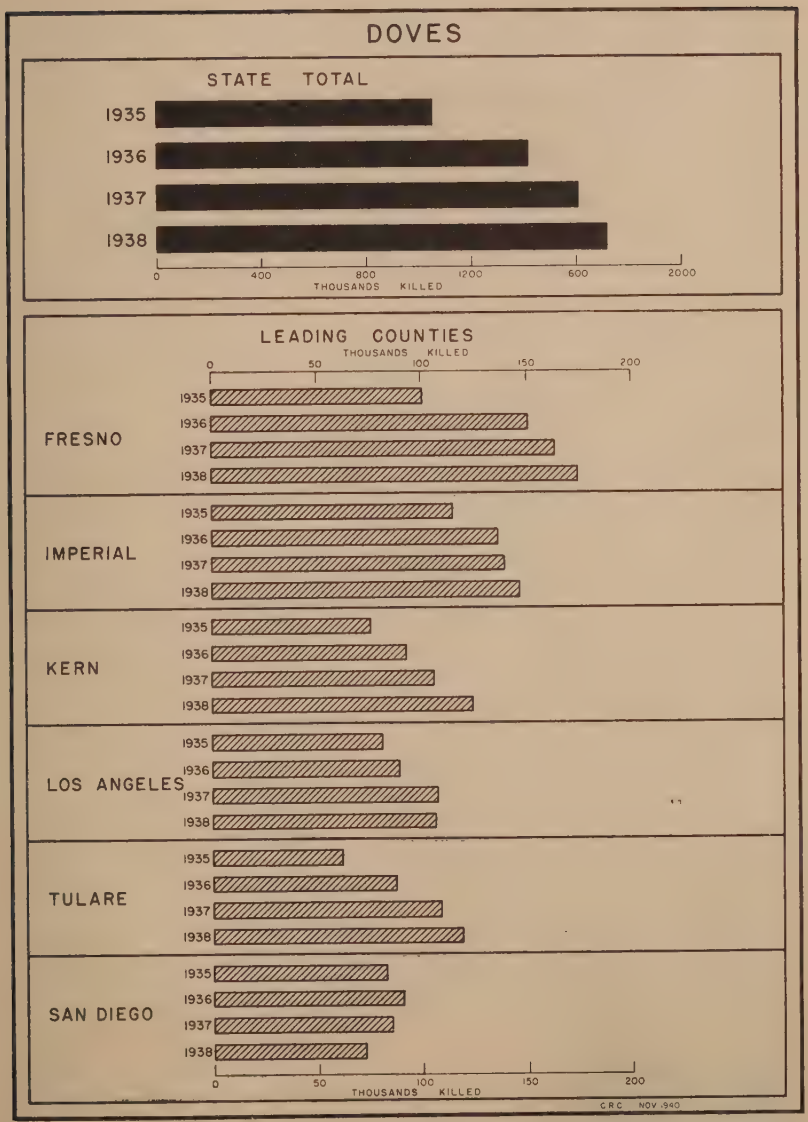

FIG. 6. In 1935 the dove season opened September 20 instead of September 1. Doves move south as cold weather approaches and the later the season opens the fewer birds will be found. This effect is more marked in the northern counties, less so in the south.

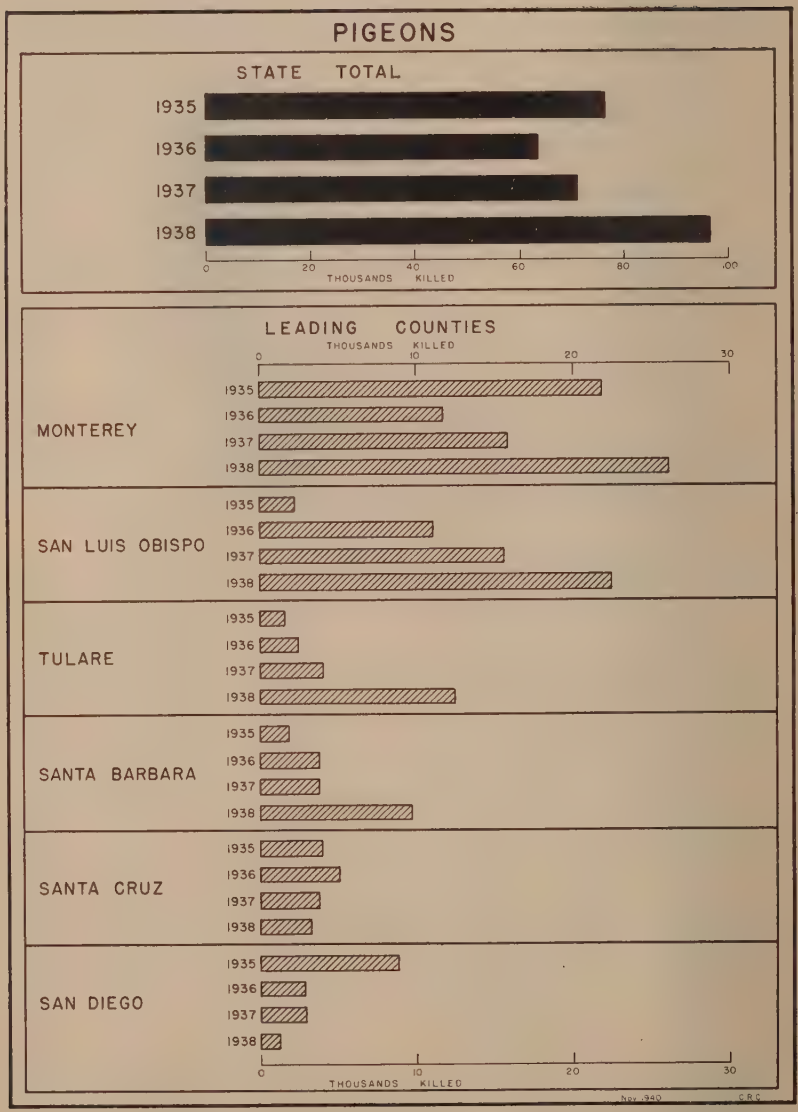

FIG. 7. Pigeon flights are the result of food conditions. If the birds find poor feeding in one place they move to another. As a result, an area which has good pigeon shooting for years may suddenly be deserted, while thousands of birds appear unexpectedly in some nearby county.

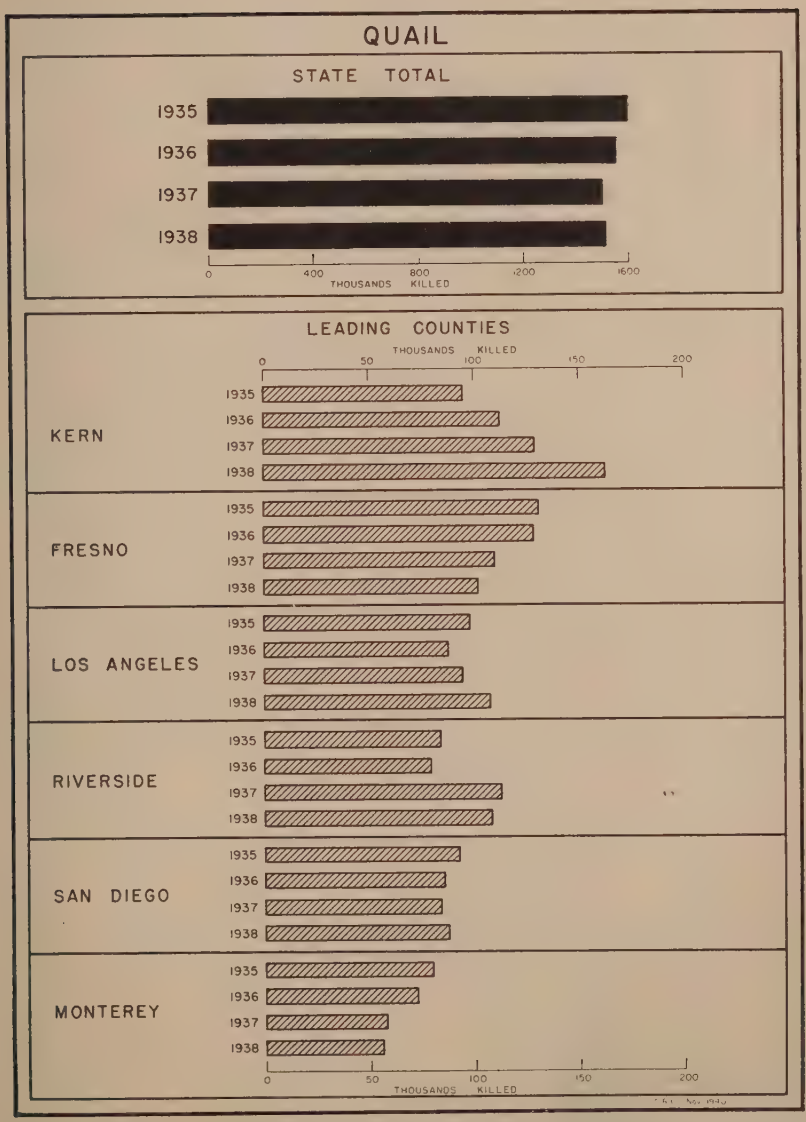

FIG. 8. Quail are subject to quite marked natural fluctuation. From 1935 through 1938, increases in some areas were balanced by decreases in others to such an extent that the kill for the State as a whole remained roughly constant.

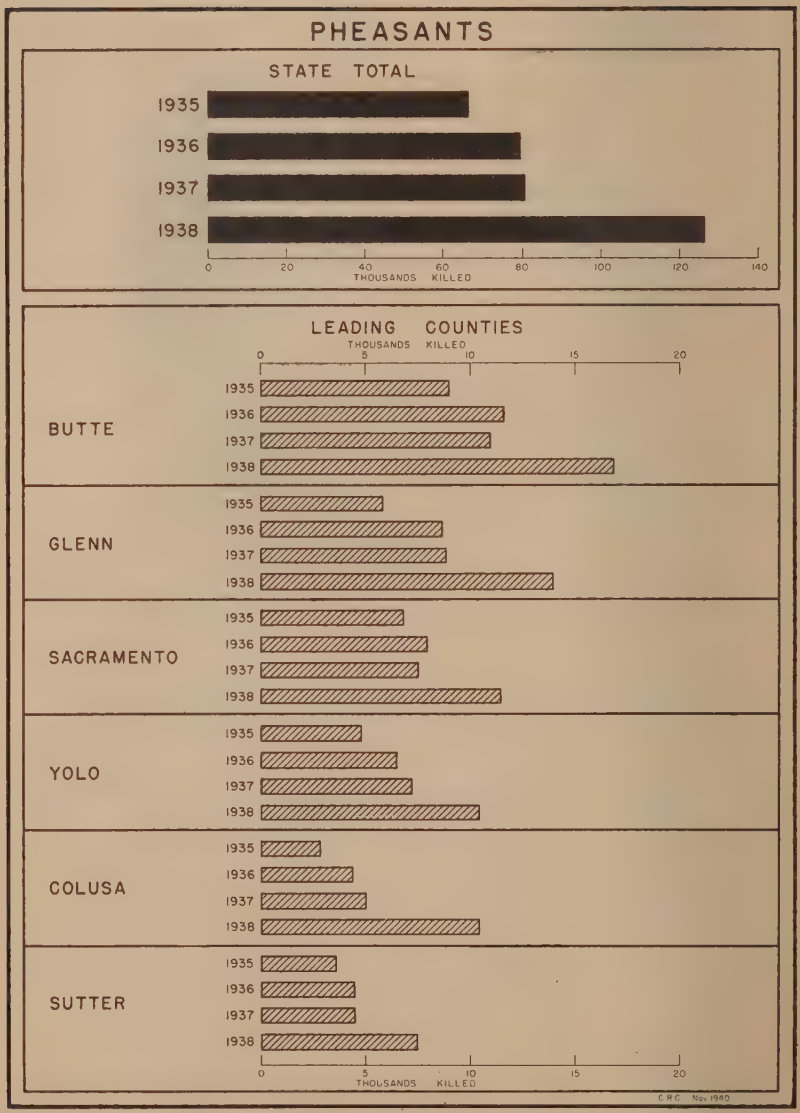

FIG. 9. The pheasant is an introduced species which is doing quite well in California, especially in the rice fields of the Sacramento Valley.

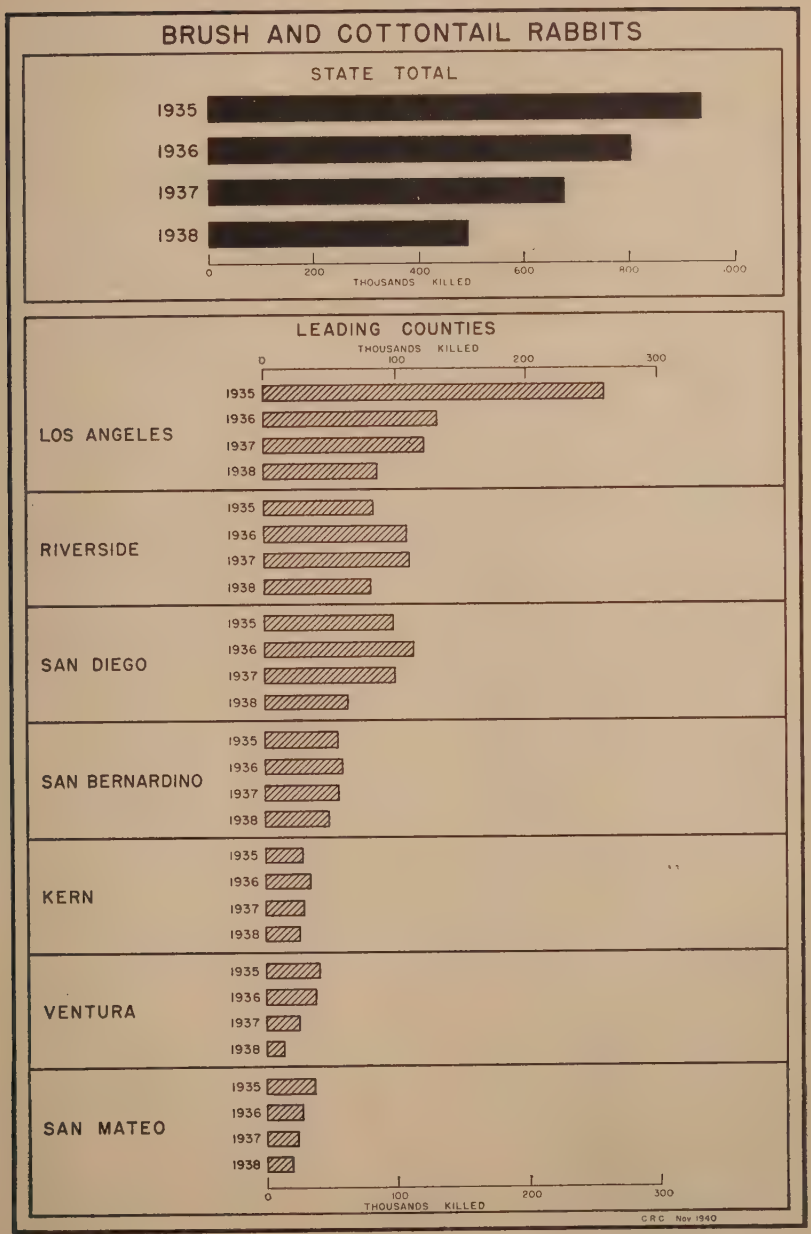

FIG. 10. The population of rabbits varies from year to year. They breed up to a maximum, then for some reason such as disease or poor breeding they become less abundant. This results in a fluctuation of numbers without apparent rhyme or reason.

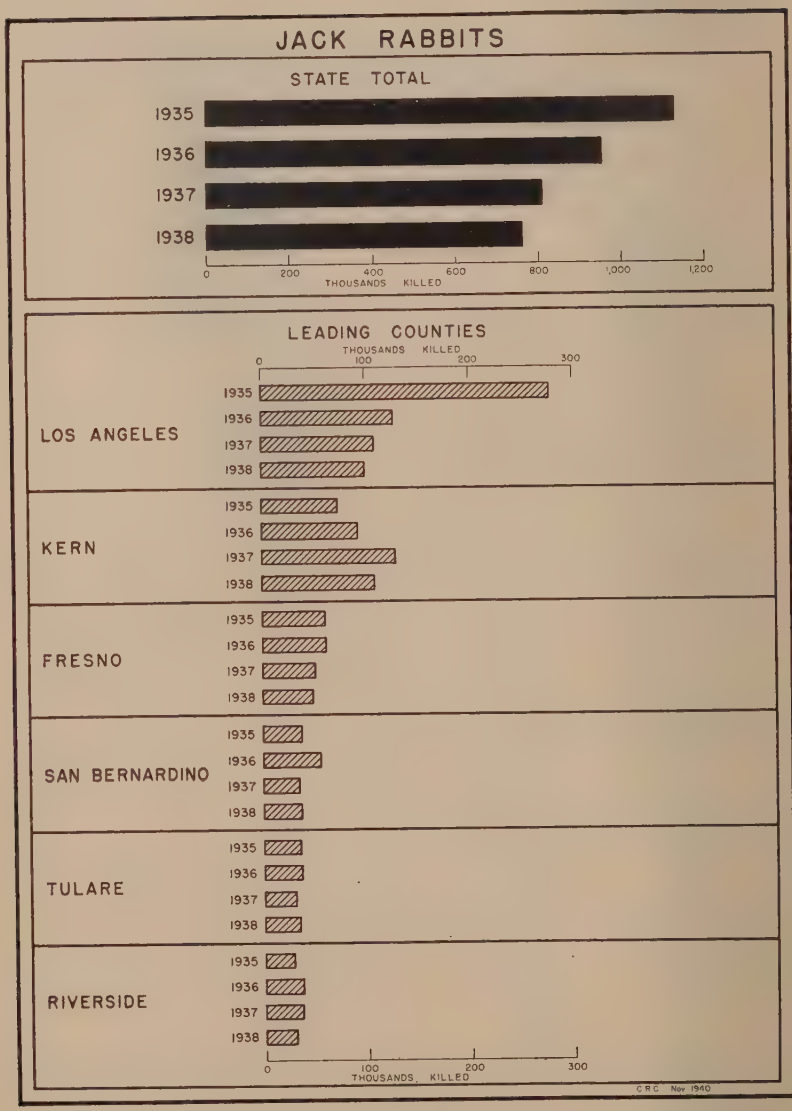

FIG. 11. Jack rabbits, like their smaller relatives, are subject to cycles of abundance and scarcity.

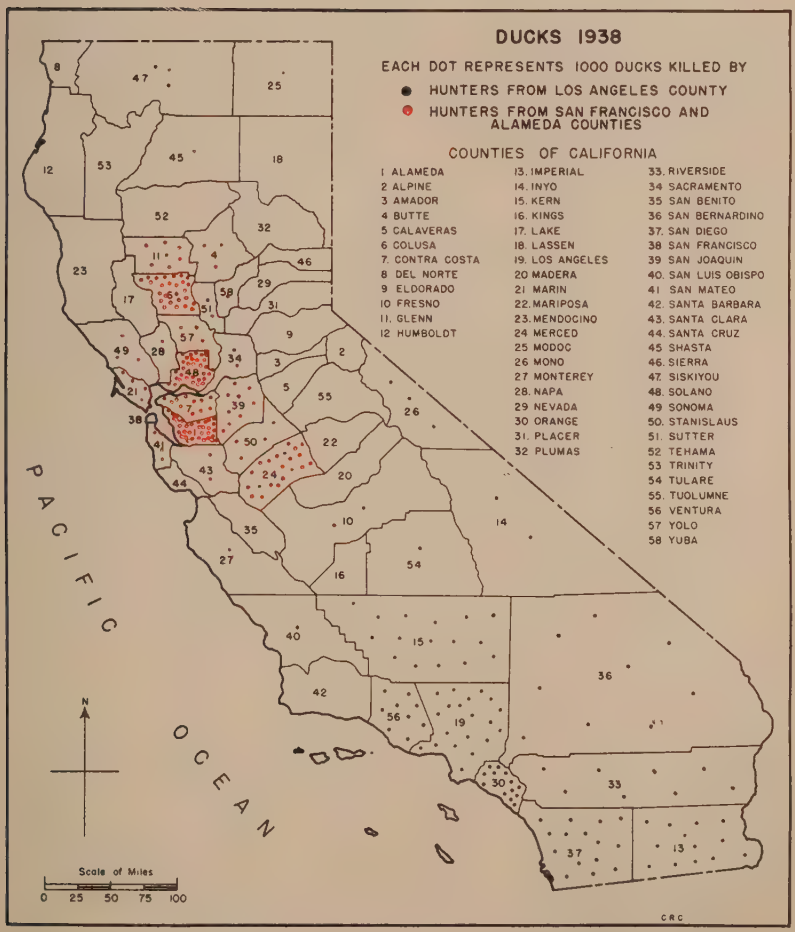

FIG. 12. Ducks killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their ducks.

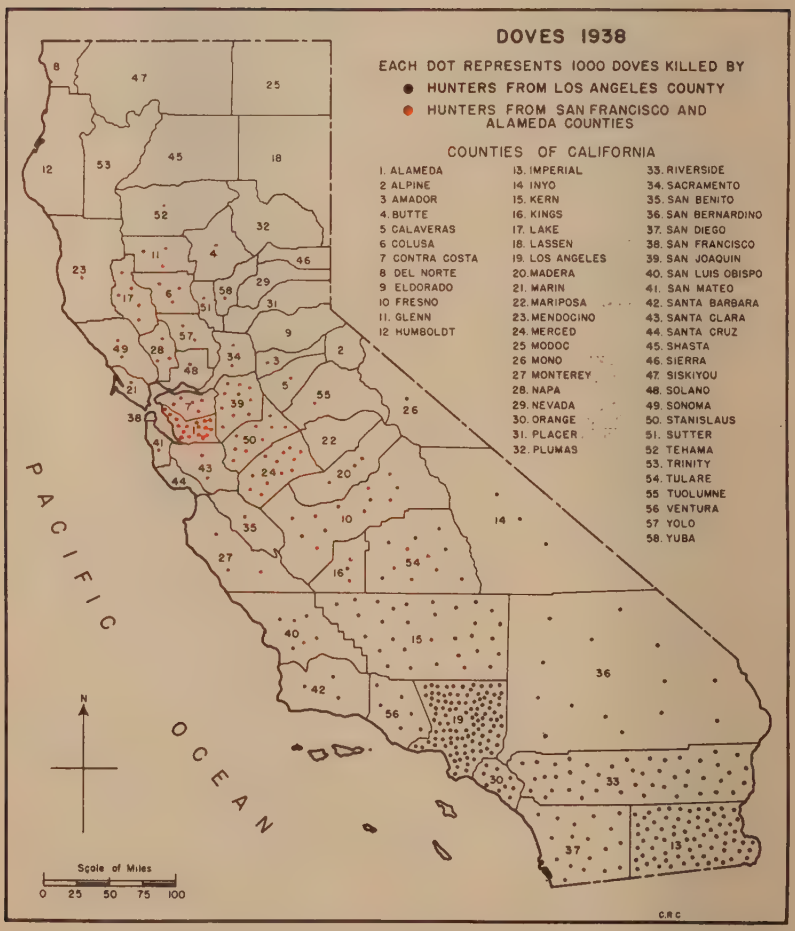

FIG. 13. Doves killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their doves.

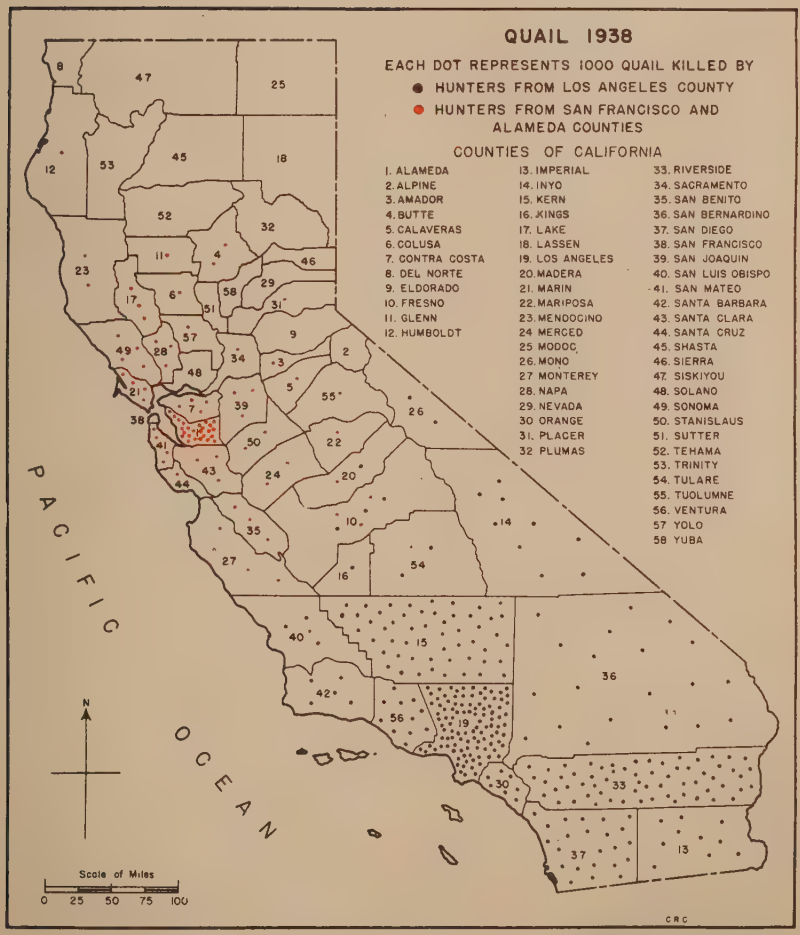

FIG. 14. Quail killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their quail.

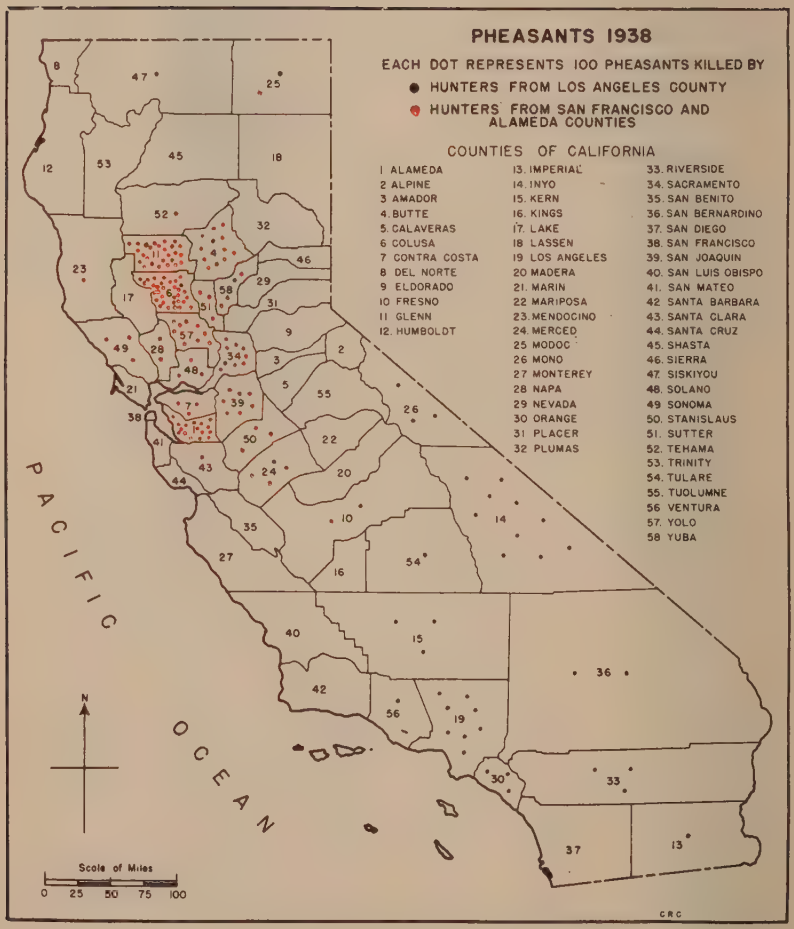

FIG. 15. Pheasants killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their pheasants.

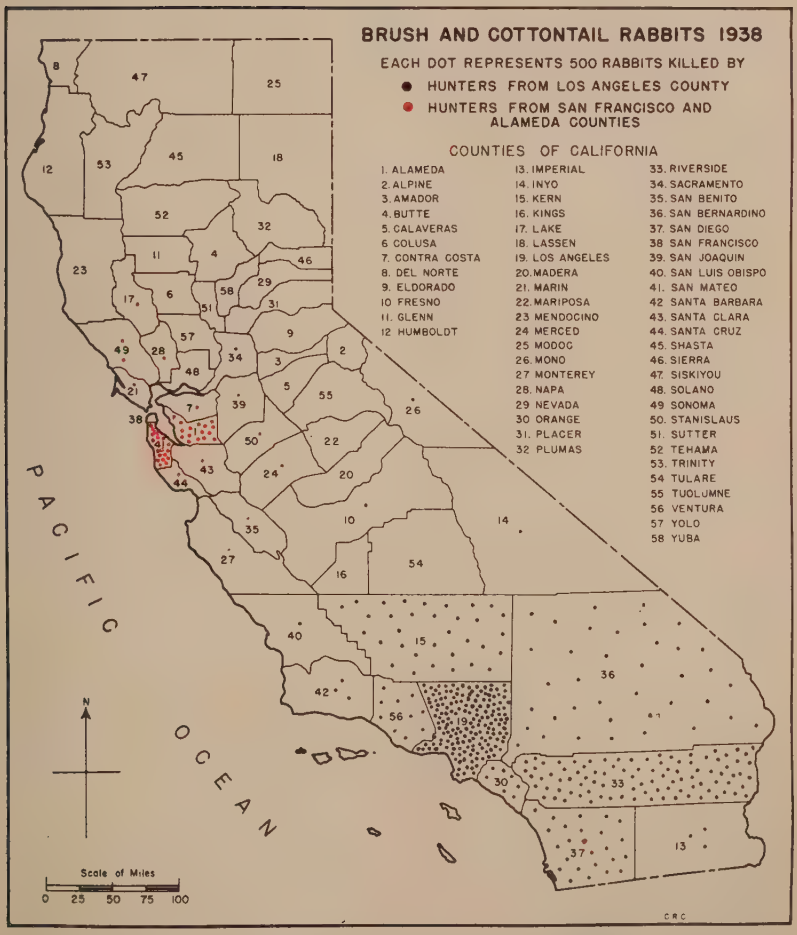

FIG. 16. Brush and cottontail rabbits killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their rabbits.

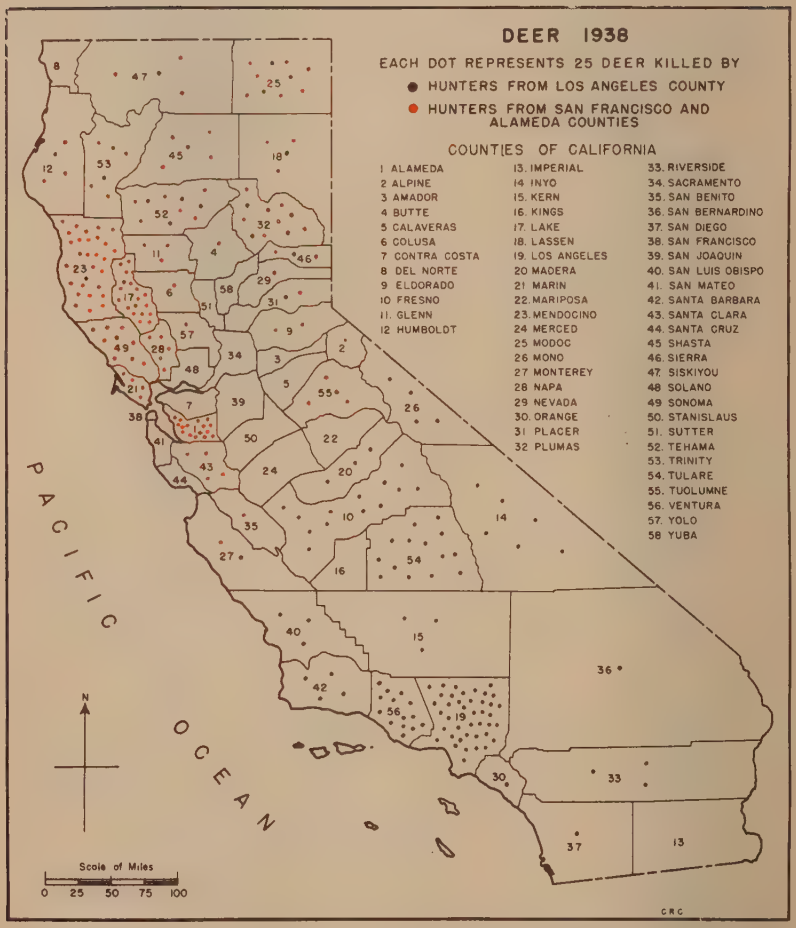

FIG. 17. Deer killed by hunters from three metropolitan counties. This map shows where the hunters of Los Angeles, San Francisco and Alameda counties bagged their deer.

PACIFIC CUTLASSFISH

Trichiurus nitens Garman [1]

By Carl L. Hubbs and Clark Hubbs
University of Michigan Museum of Zoology

In identifying two adult cutlassfish from the San Pedro fish market, we have determined that the Pacific species is distinct from the Atlantic cutlassfish, *Trichiurus lepturus* Linnaeus. These two specimens were collected by us on August 24, 1934, among miscellaneous fishes—some still alive—which had been brought in during the night and early morning by small fishing boats. There is therefore little doubt that they came from the immediate vicinity of San Pedro, California.

This remarkable type of fish was first reported from California by Elmer Higgins (1921), who recorded the capture of two specimens in water three to five fathoms deep off Long Beach. One of these specimens is now in the University of Michigan Museum of Zoology. Higgins referred his specimens to the Atlantic species, *Trichiurus lepturus,* indicating that previous Pacific Ocean records were for Panamá, Lower California and Japan.

A study of available material and of the pertinent literature, however, indicates that *Trichiurus lepturus* is confined to the Atlantic Ocean. The species of the eastern Pacific was adequately described by Garman (1899, pp. 69-70) under the name of *Trichiurus nitens.* The type specimens were dredged by the *Albatross* at Stations 3354 and 3389, near Trujillo, Peru, at stated depths of 210 and 322 fathoms. However, these seemingly pelagic fish may have entered the open dredge near the surface.

Apparently overlooking Garman's description, Meek and Hildebrand (1923, pp. 328-329), in their great monograph on the marine fishes of Panamá, recorded *Trichiurus lepturus* from both coasts of the Isthmus. Although pointing out characters in which the Pacific and Atlantic specimens differed, they refrained from separating the two series into distinct species. "To determine definitely the exact relationship," they added, "a larger series of specimens from the Pacific coast is necessary." They had only two specimens from the Pacific side of Panamá, one from Guatemala and one from Lower California.

Jordan, Evermann and Clark (1930, p. 262) recognized *Trichiurus nitens* as a valid species but erroneously indicated its type locality and range as the Galápagos Islands. They surmised, "This or a similar species in the Gulf of California," but made no mention of the records for Panamá, Guatemala or southern California.

The specimens of *Trichiurus nitens* at hand from California confirm the distinctive features of the Pacific species as pointed out by Garman and by Meek and Hildebrand. Garman counted 120 to 127

[1] Submitted for publication, June, 1940.

dorsal rays in *nitens*, and 134 to 137 in *lepturus*. The counts by Meek and Hildebrand were 120 to 128 (average, 122.5) for four Pacific specimens, and 126 to 137 (average, 132.9) for 10 from the Atlantic. The three California specimens have 120 to 122 dorsal rays (counting the last two as one), whereas four Atlantic examples (from Great South Bay in New York, Ocean View in Virginia, Boca Ciega Bay in Florida, and near Biloxi, Mississippi) have 134 to 141 dorsal rays. In agreement with statements by Garman, the eye diameter enters the length of the snout 1.8 to 2.0 times in the California fish, 2.3 to 2.4 times in those from the Atlantic. Confirming the second distinction pointed out by Meek and Hildebrand, the length of the upper jaw measures 2.7 times in the head in the California specimens, rather than 2.4 to 2.6 times.

The sharpest distinction apparently lies in the weaker dentition of the Pacific species. In agreement with Garman's description of the teeth as small, the teeth of the California specimens are much shorter and very much more slender than those of the Atlantic fish.

We conclude that the Pacific cutlassfish, *Trichiurus nitens* Garman, is specifically distinct from the Atlantic form, *Trichiurus lepturus* Linnaeus. The Pacific species ranges from southern California to Peru, and would appear from available collections to be less common that *T. lepturus*.

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MACKEREL TAGGED IN LOWER CALIFORNIA IN FALL AND WINTER OF 1939-1940 [1]

By Donald H. Fry, Jr.

California State Fisheries Laboratory
Division of Fish and Game

Prior to 1939 the California Division of Fish and Game had tagged comparatively few mackerel south of the international line. The little tagging which was done in Lower California was largely experimental in nature, and unfortunately most of the fish received a type of gill cover tag which we have since learned will not stay in place more than a few months. We have modified the gill cover tags, but we have recently been able to determine that even the improved type usually works loose within two years. When it is necessary that the fish keep the tags over a long period of time, the internal tag is the only one which seems entirely satisfactory. As a result, we can say that the first tagging in Lower California from which any results could be expected was done in October, 1939. At that time the State research vessel, *N.B. Scofield,* was in Lower California working on a sardine problem. Mackerel were encountered at Blanca Bay and again just south of Turtle Bay. (See map, Fig. 18.) A total of 721 were tagged at these two places. In January, 1940, the *N.B. Scofield,* working on mackerel this time, searched the Cape Colnett-San Quentin area, found mackerel within a mile of Cape San Quentin and tagged 3937 of them. Another 727 were tagged close to the south shore of Sebastian Viscaino Bay. All of the 5385 fish just discussed were tagged with internal tags of nickel-plated steel, as this type of marker can be trusted to stay in place indefinitely and can be recovered by cannery magnets.

The first of these tags to be recovered was taken at a San Diego cannery July 13, 1940. Since that time there has been a fairly steady series of recoveries, most of them from the Los Angeles and Newport harbor canneries. The total had reached 25 by the end of November, 1940. No recoveries have been reported from below the international line, which is not surprising. There are two fish canneries in the Ensenada region, but only the smaller of these has any way in which to collect internal tags.

Summary of the Fish Tagged and Recovered

San Quentin: 3937 fish tagged, January, 1940

3 recovered at San Diego canneries. Distance, about 155 miles.

19 recovered at Newport and Los Angeles harbor canneries. Distances, about 215 and 235 miles.

1 recovered on pleasure fishing barge near San Pedro. Distance, about 240 miles.

[1] Submitted for publication, November, 1940.

Blanca Bay: 137 fish tagged, October, 1939

1 recovered at a Los Angeles Harbor cannery. Distance, about 340 miles.

Sebastian Viscaino Bay, south shore: 727 fish tagged, January and February, 1940

No recoveries up to December 1, 1940.

Vicinity of Turtle Bay: 584 fish tagged, October, 1939

1 recovered at a Los Angeles Harbor cannery. Distance, about 415 miles.

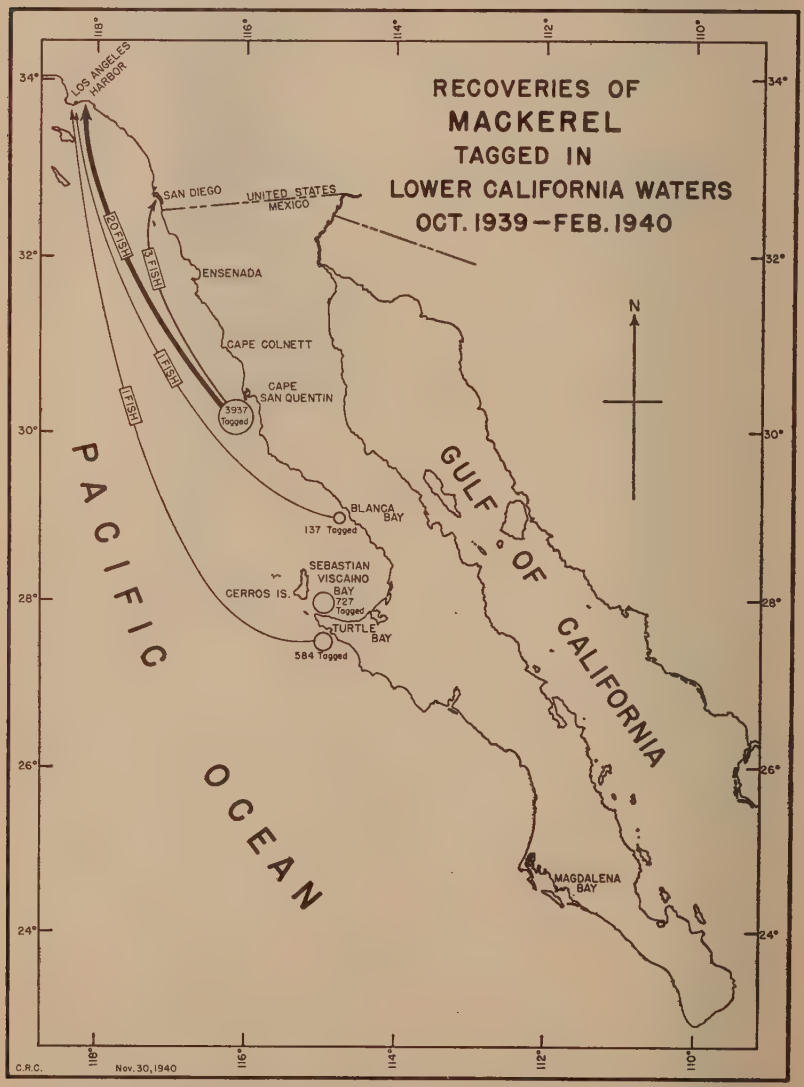

FIG. 18. Map showing where mackerel were tagged in Lower California waters during the period from October, 1939 to February, 1940. Arrow points indicate the place of recovery. All these fish were tagged with internal tags, i.e., with flat, numbered pieces of nickel-plated steel which were placed inside the body cavity. All but one of the 25 recoveries were made at canneries.

The distances just given are to the place where the fish was landed. The place of capture was probably within 25 miles plus or minus of the distance given.

The most interesting feature of these returns is the relatively small number of recoveries of fish from the two southernmost tagging areas. From the south shore of Sebastian Viscaino Bay and from the Turtle Bay area, only one fish was recovered out of 1311 tagged, whereas from Blanca Bay and San Quentin one fish was recovered from every 170 tagged. It will be interesting to see if this ratio continues during the next year or so.

Editorials and Notes

TWENTY-FIVE YEARS AGO IN "CALIFORNIA FISH AND GAME"

The first issue of volume 2 of "California Fish and Game" made its appearance in January, 1916. It was one of the best issues up to that time and contained many interesting and informative articles and notes.

An article by Carl Westerfeld, then a member of the California Fish and Game Commission, was written in answer to criticisms in the San Francisco press, regarding the handling of game resources. Editorials in one of the papers had recommended a change to the English and Scottish "practice of breeding and killing game" as the solution of our hunting problems. Mr. Westerfeld pointed out that in America the game belongs to all the people and everyone can have a chance to hunt, whereas in Great Britain the game belongs to the landowner and only a few wealthy people may shoot. The few who do hunt can make tremendously large kills and yet not deplete their supply because they can afford to breed and liberate large numbers of birds and deer. They can not eat all they shoot and hence sell the surplus, as it is their own hand-raised game. We must agree with Mr. Westerfeld that changing to the British system of hunting preserves for the landowner would be unfair to our hunters. Apparently, some papers as late as 1915 had not become reconciled to the idea of inviolate game refuges and the nonsale of game. However, some newspapers took a more progressive view as evidenced by an editorial in a Fresno daily, reproduced in the same issue of "California Fish and Game," which took the San Francisco paper to task in no uncertain terms. We still have free hunting in California for the hunter who can not afford to raise his own game—let us hope we shall always have it.

An article by research men of the U. S. Public Health Service relates the findings of experiments conducted to learn the results of ground squirrel poison on quail. The results indicated that quail could consume a great deal more strychnine sulphate than ground squirrels before death ensued; also that quail do not normally eat barley, whether poisoned or not. Consequently, they recommended barley treated with strychnine sulphate for squirrel control. Further articles in later issues of "California Fish and Game" bear out the conclusions of this early study. Apparently, the use of barley coated with strychnine sulphate and the application of gas directly into the squirrel holes are the control measures least injurious to game birds. Most complaints of quail losses arise from the use—or misuse—of other poisoning methods.

Big game fishing methods as developed at Santa Catalina Island were described by Dwight G. French. The author outlined the develop-

ment of Catalina fishing from the hand-line days up to the time trolling with kites reached the height of its development. Methods of using both the kite and the sled for presenting the bait to wary fish were described in detail. As a coincidence, the January, 1916, issue noted the death of Dr. Charles Frederick Holder, pioneer Catalina angler. Dr. Holder was a great educator, naturalist and conservationist, and it was largely due to his efforts that early Catalina fishermen became imbued with the spirit of sportsmanship.

It is gratifying to note the improvements that have taken place in fish and game management practices since Dr. Charles C. Adams, forest zoologist for the New York State College of Forestry, spoke so feelingly of the lack of knowledge and foresight prevalent in fish and game work in the various states twenty-five years ago. A speech, which was presented in New York by Dr. Adams and was reproduced in "California Fish and Game," outlined what should be known of fish and game conditions but was not, and how the various states could set about learning enough to improve these conditions. In the past few years many states have awakened and are now basing their management plans on sound scientific studies. New York, which was the state primarily under discussion, has become a leader, as have several states scattered across the country, and we feel that here in California we have made some progress toward our goal—better wildlife conditions resulting in better hunting and fishing for all.

F. W. Weymouth's article on the market crab (reprinted from the Report of the British Columbia Commissioner of Fisheries) is of interest in that California's successful crab legislation has been based very largely on scientific investigations, an example of the sort of management procedure which Dr. Adams advocated, as mentioned previously. Dr. Weymouth's work showed that some of the laws already enacted were desirable and he advocated additional legislation. The results have been excellent. (An earlier report on Weymouth's investigations appeared in the California Fish and Game Commission Fish Bulletin, no. 1, pp. 29-34, 1913.)

Apparently, present day controversies on whether hook-caught fish survive after being released are not new, as two notes in the 1916 issue disagree on that score. A. D. Ferguson, who planted many trout for the California Fish and Game Commission, maintained that trout caught on a fly and carefully handled would survive for many days in fish cans and would be healthy when released, as he had handled many in that way. W. T. Clarke cited an experiment conducted with fish caught on bait wherein two-thirds of the trout died. Perhaps the care in handling is the deciding factor.

A number of short notes on a variety of subjects rounded out the January, 1916, issue.—*Richard S. Croker, Editor, California Fish and Game.*

THE SEA OTTERS OF CALIFORNIA DID NOT REAPPEAR

The reader will recall the fanfare of newspaper misinformation of a year or two ago, heralding the phenomenal reappearance of sea otter along the coast of Monterey County, California, after an alleged complete absence for many decades. There were articles in at least two magazines of nation-wide distribution describing the rediscovery of

these strange animals after "science" had pronounced them as long ago extinct along the California coast. A booklet[1] on the subject gives a dramatic picture of this rediscovery in the "early morning of March 19, 1938." Quoting from this pamphlet, "It is some twenty-two years since even an individual specimen was sighted in the vicinity and over one hundred years ago that they were seen in such numbers; it looked like staging a come-back to their native lair. The sudden, Phoenix-like appearance was a phenomenal occurrence which astonished everybody and from whence they came a puzzle which remains as yet unsolved."

Far be it from us to throw cold water upon the romantic exploits of any of the denizens of the deep. In the case of the sea otter, however, the truth about these "sea beavers," as the Russians called them, is so dramatic, the part they played in the settlement of this state is of such historic interest and their habits are so intriguing that the fiction of their disappearance and sudden reappearance seems by contrast to be a very inferior substitute.

Scattered in many reference books is to be found much that has been published about the sea otters, called by Charles M. Scammon ("The marine mammals of the north-western coast of North America") in 1874 "the most valuable fur-bearing animals inhabiting the waters of the north-western coast of America." The value of these furs led to competition for the pelts and the growth of a pioneer coastal trade, so that a full account of the sea otter is the romantic story of early California. The complete story should tell of the otter hunting by adventurers of many nations from the time of the founding of Fort Astoria on the Columbia, of the occupation of the northern coast of California by the Russians seeking furs, of the Spaniards' concern and their establishment of California missions to hold the country for Spain. Later, Mexico attempted to halt the slaughter but poaching was rife till the supply of animals was so reduced that large scale systematic hunting had to be abandoned, although scattered kills continued during the time Alta California seceded from Mexico, set up the California Republic and later joined the Union as a state. Finally, so few animals were left that it was feared the species would be exterminated, and in 1913 the California Division of Fish and Game sponsored legislation giving complete protection to these fur-bearers, but even then poaching was not entirely halted and a few men risked long prison sentences for the chance of financial gain through illegal sale of the valuable pelts.

There was no disappearance and magical reappearance of the sea otter. The State Division of Fish and Game well knew the species survived along the little frequented Monterey-San Luis Obispo County coast. Not only were the animals carefully guarded by officers of the Division, but ranchers along the coast took an active interest in the enforcement of the laws protecting otter and reported the presence of poachers. Then came the building of the Carmel-San Simeon highway with the inevitable discovery by the general public of the presence of the "sea beavers" and their private lives became public property with the details photographed and advertised in the morning papers.

[1] Macdonald, A. S. Sea otters choose California coast. Oakland, California, 1938.

Harold C. Bryant writing in 1915 in "California Fish and Game" (vol. 1, no. 3, p. 96) said "Although once exceedingly numerous along the coast, the sea otter is now nearing extinction. Two or three were killed just before the law protecting them went into effect in 1913, but

FIG. 19. Mule deer found July 19, 1940, at Medicine Lake, Siskiyou County, by Mrs. D. D. Brownell. The antlers are so large that the deer could not hold up its head. Photograph by A. M. Zeppernick.

few have been reported as having been seen since that time." In the April, 1917, issue of "California Fish and Game," P. H. Oyer published an account of two sea otters being seen on October 22, 1916, near Del Monte in Monterey Bay, and he mentioned one being caught in a sea-bass net "last year," which probably meant 1915. George Farnsworth (California Fish and Game, vol. 3, no. 2, 1917) published a note of having counted 31 sea otter on March 18, 1916, to the south of Catalina Island. Joseph Grinnell [2] published in 1933 this statement concerning sea otter: " * * * individuals have been reported as seen almost every year off coasts of Monterey and San Luis Obispo counties."

The writer, when engaged at Monterey on salmon work for the Division of Fish and Game in the summer of 1919, became interested in the exciting stories told by Deputy Phil Oyer of a sea otter poacher of Monterey. This man had killed three or four animals and had sold the pelts at good prices in spite of the close watch being kept over

[2] Grinnell, Joseph. Review of the recent mammal fauna of California. University of California Publications in Zoology, Vol. 40, No. 2, p. 104, 1933.

the two or three known bands of otter down the coast. This hide-and-seek game with law enforcement officers became too hot for the poacher and he had left the state hurriedly to avoid arrest a short time preceding 1919. Deputy Oyer suggested that the presence of the animals had best not be broadcast because the fewer people knowing their whereabouts, the less the chance of poachers. He told of having watched the otter on several occasions and of the interest in their preservation by the local ranch owners of that part of the coast. In those days a journey over the wagon road from Carmel to the Big Sur was an adventure in itself, and from there on, deer hunters hiked or were landed at the foot of the cliffs from a boat. There were few people along that wild coast to disturb what we now consider our most interesting marine mammal.—*W. L. Scofield, California State Fisheries Laboratory, Division of Fish and Game, August, 1940.*

FREAK ANTLERS OF MULE DEER

When Mrs. D. D. Brownell, at Medicine Lake, Siskiyou County, California, found the mule deer whose antlers were so enlarged that their weight and the poor physical condition of the deer prevented the animal from carrying its head erect, Mr. Beebe of the United States Forest Service, with permission of the California Division of Fish and Game, on July 19, 1940, killed the animal as a humane measure. The position in which the head was carried is shown in figure 19. The

Fig. 20. Close-up view of antlers of the deer shown in figure 19.

close-up view (Fig. 20) of the antlers, which are in the velvet, indicates their tremendous size; a weight of 17 pounds was recorded for them and the attached frontlet. Through Messrs. L. F. Chappell and Don Chipman of the State Division of Fish and Game, Mr. D. D.

Brownell deposited the antlers in the study collections of the California Museum of Vertebrate Zoology.—*E. Raymond Hall, University of California, Museum of Vertebrate Zoology, October, 1940.*

ELK TEETH IN CALIFORNIA DEER

Deer (genus *Odocoileus*) differ from wapiti or elk (genus *Cervus*) in lacking the upper canine teeth, commonly referred to as elk teeth. Rarely, nevertheless, canines do occur in deer as shown by the lower one of the two skulls in figure 21. Whereas the canine tooth in a wapiti is about the same size as the anteriormost premolar (cheek tooth), in this deer the canine is much smaller than the premolar.

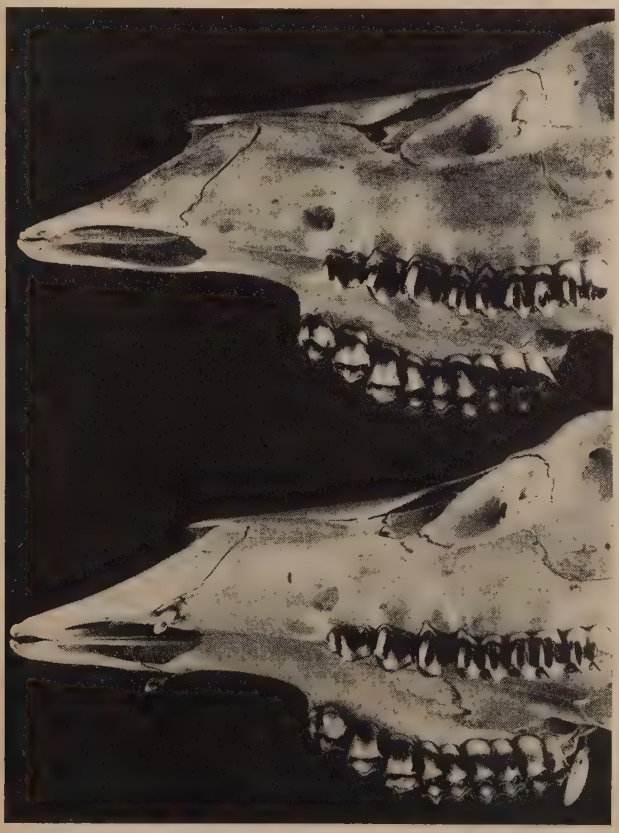

FIG. 21. Palatal views of the skulls of two male deer viewed obliquely from the left side.

Note the canine teeth (elk teeth) in the lower skull and their absence in a normal skull above. Photographs by W. C. Matthews, x ½.

Upper: Buck, mule deer (*Odocoileus hemionus*, M. V. Z. No. 54970), showing normal arrangement of teeth, shot September 19, 1932, by J. Crowley, at Chester, Plumas County, California.

Lower: Buck, mule deer (*Odocoileus hemionus*), with canine teeth, shot in September, 1940, by Charles L. Fread, on the upper rim rock of Halls Meadow, Hat Creek, Lassen County, California.

Measurements of the left canine in the deer skull figured herewith are: Length of outside (labial), exposed part, 9.3 mm.; anteroposterior diameter of crown, 4.0 mm.; transverse diameter of crown, 2.9 mm.

The skull with the canines is from a deer sent to me on September 23, 1940, for mounting, by Dr. Charles L. Fread of Oakland, California. The animal was shot on the "upper rim rock, of Halls Meadow, Hat Creek, Lassen County, California." No peculiarities other than the canine teeth were noted; the deer had four points on the right antler and three on the left.

Another deer skull with similar canine teeth was received for mounting in 1921. The tooth-bearing part of the skull is in the collection of the California Museum of Vertebrate Zoology (catalog number 32439). This buck was shot on October 10, 1921, by A. J. Rupley, at the head of the North Fork of Silver Creek, El Dorado County, California. The canine teeth in this specimen are practically identical with those in the animal from Lassen County. The one difference noted is the slightly greater transverse diameter (3.5 mm.) of the crown in the animal from Lassen County.

In the course of my taxidermy work, more than four thousand heads of male deer have passed through my hands, but canine teeth were noted in only the two described above.—*Gus Nordquist, Taxidermist, Oakland, California, October, 1940.*

A FISHING RECORD

The urge to collect things and to break records is something that most of us have. Some collect first editions, stamps, second-hand auto parts or sea shells, some see how many wild animals they can photograph or shoot or how many kinds of fish they can catch. One of our friends has set out to catch and photograph every kind of fish found throughout the length and breadth of California, and now we learn of a man who has tried to catch, by angling methods, as many fish of as many kinds as possible in one locality. As proof that fishing is still good in California, he has indeed set a remarkable record.

The fisherman is F. R. Hering and the place he does his fishing is aboard the barge anchored in Santa Monica Bay off Ocean Park. Captain Robert Oefinger made his record available to the writer.

During the period from February 3, 1937, to October 29, 1940, Mr. Hering spent 492 days fishing from the barge. His total catch numbered 30,487 fish, mollusks and crustaceans, for an average of 62 per day. During this time he also "broke four poles, brought up three poles, two bait buckets, miscellaneous fishing equipment, various junk, etc." On his worst day he caught but one fish and on his best the catch was 178.

The following list gives the species caught. The names given are those used by Hering, with our notes in parentheses.

No. caught	*Species*	*No. caught*	*Species*
12,342	Kingfish	11	Turbot
9,309	Mackerel	7	Whitefish (*Caulolatilus*)
6,084	Chinese smelt (*Oxyjulis*)	6	Skates
1,099	Sand dab	5	Candlefish (Lizard fish, *Synodus*)
550	Perch (*Embiotocidae*)	4	Barracuda
309	Horse mackerel	4	Cabezone
185	Smelt (*Atherinidae*)	3	Pearl fish (?)
84	Sole	1	Anchovy
70	Sculpin (*Scorpaena*)	1	Cultus
67	Blenny	1	Ribbon fish
60	Sharks	1	White sea-bass
40	Sea robbin (cabezone?)	70	Crabs
27	Queenfish	4	Mantis shrimps (*Squilla*)
21	Bass (*Paralabrax*)	2	Spiny lobsters
16	Sardines	52	Conchs (Whelks)
15	Halfmoon	14	Octopus
11	Chilipeppers	1	Cockle
11	Halibut		

The question naturally arises: how many fishermen make such large catches, but because of failure to keep records the results of their fishing are never made known? We would like to think that this note would lead anglers to record their catches rather than to aspire to greater bags, to seek for the greater variety not for the heavier sackful. Mr. Hering saw to it that his fish were given to needy families—how many anglers take the trouble to make full use of their catches?—*R. S. Croker, California State Fisheries Laboratory, Division of Fish and Game, November, 1940.*

Reviews

American Mammals: Their Lives, Habits and Economic Relations

By W. J. Hamilton, Jr. New York, McGraw-Hill Book Co., Inc., 1939. 419 pp., 92 figs., bibliography, index. $3.75.

Most of the books on mammals which have appeared to date have dealt primarily with the classification and distribution of species and have told us very little of the mammals as such. Here, finally, is a book which tells us what mammals are and what they do.

Mr. Hamilton has done his job well, though apparently somewhat hurriedly. In reading some of the chapters, particularly the one on food habits, we realize how little we actually know about many of the members of the class Mammalia. This lack of vital information serves to emphasize the importance of continued research into the life-histories and habits of this group.

The book begins with a chapter on the ancestry of mammals. The second chapter deals briefly with classification, and successive chapters with characters and adaptation, food, habitats, various phases of life-history, behavior and distribution. In the concluding chapters, the author has roughly divided the mammals into groups, using as a basis for this division their relationship to man. The useful and injurious mammals are considered separately, as are the game mammals, the fur-bearers and the predators.

Students of wildlife will find this book useful and stimulating.—*Gordon H. True, Jr., Bureau of Game Conservation, California Division of Fish and Game.*

Salt Water Fishing Tackle

By Harlan Major. New York, Funk & Wagnalls Co., 1939. 284 pp., 64 pls., 84 figs., index. $5.00.

The most nearly complete book on salt-water fishing and fishing tackle yet seen by this reviewer is *Salt Water Fishing Tackle.* The author, Harlan Major, is a noted angler with world-wide experience and can write with authority on all phases of ocean angling.

The opening chapter deals with the primitive tackle of early man and leads up to the discussion on the development of modern tackle, which is by no means perfect as yet.

Every phase of salt-water tackle is discussed thoroughly—from the boat to the bait. Not only is the fishing rod described as the fisherman sees it, but the theory and practice of building it are presented, even to a description of the way to grow and choose the wood. Also, the proper ways to use and care for the finished rod are described. Discussions of reels, hooks, line, gaffs and fishing chairs are equally complete.

Although the book is concerned primarily with the tackle itself, fishing methods are not neglected. From his experience the author gives a great deal of advice on how to attain the best results in trolling, still fishing and surf fishing. Having fished in many waters, his book does not confine itself to the methods in vogue in but one area. Although Major's personal inclination is apparently toward trolling, especially for big game fish, other phases of angling receive their share of attention, and the best ways to catch the most humble bottom fish are described. Even "goggle fishing," the sport of divers, and the use of cotton thread for a line are given space.

Numerous drawings by J. B. Junghans adequately illustrate the text. There are also 64 plates consisting of a great many excellent photographs. The quality of the writing sets a high standard with the result that the book is not only informative but highly readable.

A chapter on tournament surf casting is contributed by August Livenais, Jr., holder of the world's distance record. Those who would like to improve their casting would do well to read this chapter as well as Major's discussion of the subject. George W. Garey contributes a chapter in support of fishing with the reel held under the rod instead of above it as most anglers, including Major, do their fishing.

This book is recommended to all fishermen.—*Richard S. Croker, Editor, California Fish and Game.*

A Handbook of Salt-water Fishing

By O. H. P. Rodman. New York, Frederick A. Stokes Co., 1940. 274 pp., illus., index. $1.75.

The author of this handbook is an experienced and enthusiastic salt-water fisherman. He has crammed a surprising amount of worth while information on fishing tackle and methods into this pocket-size book.

The book starts with an invitation to give salt-water fishing a trial. This introduction is followed by a series of brief descriptions of ocean game fish (including some that highbrow anglers refuse to call "game fish") along with notes on tackle and fishing methods. This list includes not only Atlantic species but the better known Pacific Coast fish. Separate chapters are devoted to surf casting, still fishing from boats and piers, trolling and big game fishing. These subjects are well balanced but the reader arrives at the conclusion that Rodman's favorite sport is casting into the breakers. Throughout, emphasis is placed on East Coast fishing, but there are many references to the Gulf of Mexico and the Pacific Coast. Much of the information is given in such a way that it would prove useful to the aspiring salt-water angler who fishes along any coast or in any sea.

The chapter on conservation of fisheries resources is well handled. The final chapter gives a number of useful tips on care and use of tackle, keeping fish, selection of artificial lures and live bait, etc.

The reviewer recommends this handbook as a useful guide to the beginner and an equally useful reference for the veteran of the sloughs, beaches and open ocean. A waterproof case is provided so that the book can be taken on actual trips, but if you prefer to leave the book in the safety of your library, the case is ideal for carrying hooks and leaders.—*Richard S. Croker, Editor, California Fish and Game.*

Development of the Eggs and Early Larvae of Six California Fishes

By Paul L. Budd. California Division of Fish and Game. Fish Bulletin, no. 56, 50 pp., 91 figs., 1940.

Mr. Budd has made a valuable contribution in an important field which has been sadly neglected on the Pacific Coast of North America. The ability to recognize a fish at all stages of its life-history is a prime desideratum, not only in pure science but in its economic phase of conservation. It is, therefore, unfortunate that only a small proportion of our marine fishes can be specifically determined before they have attained the adult form. With the publication of this work, the eggs and early larvae of four commercially important flatfishes (the pointed-nosed sole and three turbots), as well as two cottids of no economic significance, have been added to the list of known forms.

The paper contains a brief discussion of fish eggs in general, and a description of the apparatus used in keeping the material alive in the laboratory. It then presents detailed descriptions of numerous developmental stages of the eggs and larvae discussed. A number of different characters are noted which will serve for the recognition of the eggs and larvae at various stages. For example, the turbot eggs are unique among those of California fishes in having the shell marked by a characteristic hexagonal pattern, whereas each of the three species of turbots may be distinguished from the others by well marked differences in the size of the eggs themselves. After hatching, the larvae may be distinguished from the other species by variations in size, body proportions and color patterns.

The amount of time required to reach each particular stage is noted. This is important since future investigators will often wish to know the age of material collected from the ocean, or may attempt to estimate the distance the eggs have drifted since laying. Schedules of developmental time must therefore be established for each species investigated, since the developmental rate varies widely. The pointed-nosed sole hatches in about four days, the sharp-ridged turbot in five days, the mottled turbot in twelve days, and one of the tide-pool cottids required almost a month for hatching.

Of utmost value are the numerous carefully prepared figures which illustrate almost every stage in the development of each of the species discussed.—*Rolf L. Bolin, Hopkins Marine Station, Stanford University.*

The World Under the Sea

By B. Webster Smith. New York and London, D. Appleton-Century Co., Inc., 1940. 230 pp., illus. $3.00.

In compiling this readable book on life beneath the ocean's surface, the author, B. Webster Smith, has added to his personal observations the accumulated results of the research of all the great oceanographers and marine biologists. The book has been designed for those who can not make exhaustive studies of their own—the laymen. Its purpose is to interest them in marine life and give them a better understanding of what goes on beneath the surface of the sea. In this aim it is a successful book. It presents in a simple style, which should be easy for the non-scientist to follow, many interesting and remarkable facts about submarine life.

The first chapter outlines what we know about the sea and who made the discoveries. This part is an excellent resume of the history of oceanographic exploration. Following chapters describe the bottom of the sea, submarine earthquakes and volcanoes, currents and tides and the general physics of the ocean. The remainder of the text takes up the various kinds of organisms found in the sea, with the greatest emphasis on animals rather than on plants.

As the writer is an Englishman, the book treats largely with English forms of marine life, but not to the exclusion of tropical, polar and American species; in fact, a good balance has been maintained throughout.

The illustrations are numerous and for the most part very good.

The World Under the Sea is recommended to all who are interested in the ocean, especially the beginning student and the dilettante. To the marine biologist, it will seem a little elementary but he can enjoy it, searching for the inevitable minor errors of omission and commission that occur occasionally. The reviewer personally enjoyed the accounts of the whales, deep-sea fishes and many of the invertebrates, especially the corals, as well as the introductory chapters on the ocean itself.—*Richard S. Croker, Editor, California Fish and Game.*

A Manual of Aquatic Plants

By Norman C. Fassett. New York and London, McGraw-Hill Book Co., Inc., 1940. 382 pp., illus. $4.00.

A Manual of Aquatic Plants is a good example of what a manual should be. Our only regret is that it treats of Eastern plants and not those found in Western waters. The book describes and provides keys for the fresh-water plants (except those of microscopic size) of the region from Minnesota and Missouri eastward. A general key for the identification of water plants is followed by the descriptions of all species and varieties. The text is accompanied by separate keys for the more complicated families and genera. The descriptions are illustrated with excellent drawings, most of which were made by graduate students. The author points out that identification can be made from the pictures and that the text and the keys simply interpret the drawings and call attention to obscure features.

The author is an associate professor of botany at the University of Wisconsin, which fact is reflected in this manual. All science at Wisconsin seems to have as its goal proper wildlife management and *Aquatic Plants* has been designed for the use of the wildlife biologist. Of great value are the sections "Use of Aquatic Plants by Birds and Mammals" and "The Relation of Plants to Fish," each with its bibliography. All plants which are of value to wildlife in any way are listed with a brief summary of what kinds of animals use them, and as a cross reference the various animals are listed along with the plants they utilize.

There is an index, and an excellent glossary has been provided.

There is no question that this manual will be a boon to the Eastern wildlife worker and it should also be of considerable value to Westerners.—*Richard S. Croker, Editor, California Fish and Game.*

IN MEMORIAM

MERRILL W. BROWN

The untimely death of Merrill W. Brown is recorded with deepest sadness. He passed away suddenly at his home in Elk Grove, Sunday, December 8, 1940.

Mr. Brown was born in Rhode Island, May 14, 1903. He was graduated from the University of Redlands in 1927 and received his master's degree at Stanford University in 1929, following which he worked for the U. S. Bureau of Fisheries for a year. He came to the Division of Fish and Game on June 15, 1930, working for the Bureau of Marine Fisheries on the Klamath River.

In May, 1932, he transferred to the Bureau of Fish Conservation, taking charge of the Friant Bass Ponds. When the Central Valleys Hatchery was established, he took charge of that station where he remained until his death. He was also in charge of the fish rescue crews operating in the Sacramento and San Joaquin valleys.

He had become an outstanding authority on black bass culture and fish rescue work. Through these activities he had acquired a wide acquaintance among sportsmen's groups, and his cheerful and understanding manner made him one of the most popular men in the service.

To his widow, Trula Pratt Brown, and daughter, his many friends in the Division extend their sympathy.—*A. C. Taft, Chief, Bureau of Fish Conservation, Division of Fish and Game.*

REPORTS

STATEMENT OF REVENUE

For the Period July 1, 1940, to September 30, 1940, of the Ninety-second Fiscal Year

Revenue for Fish and Game Preservation Fund:		
License Revenue—		
1940 Series:		
Angling	$268,034 50	
Hunting	159,041 00	
Commercial hunting club	100 00	
Commercial hunting club operator	15 00	
Trapping	56 00	
Fish packers and wholesale shell fish dealers	725 00	
Deer tags	57,370 00	
Fish tags	1,052 00	
Game tags	140 04	
Market fishermen	20,570 00	
Fishing party boat permits	129 00	
Fish breeders	35 00	
Game breeders	67 50	
Game management	140 00	
Kelp licenses	10 00	
Total, 1940 series		$507,485 04
1939 Series:		
Angling	$4,767 50	
Hunting	9,201 00	
Trapping	79 00	
Deer tags	1,324 00	
Market fishermen	200 00	
Total, 1939 series		15,571 50
Total licenses, 92d fiscal year		$523,056 54
Other revenue:		
Court fines	$8,362 88	
Fish packers	15,489 17	
Kelp tax	97 38	
Miscellaneous revenue	2,717 30	
Salmon packers	9,972 18	
Total, other revenue		36,638 91
Total revenue, 92d fiscal year		$559,695 45
Prior year—		
1937 series	—34 50	
1928 series	—3,626 68	
Fish packers	—260 92	
Total prior year, 91st fiscal year		—$3,922 10
Grand total—all years, Fish and Game Preservation Fund		$555,773 35

STATEMENT OF EXPENDITURES

For the Period July 1, 1940, to September 30, 1940, of the 92d Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Education and public information	$395 16	$19 52	$261 20	$120 75	$796 63
Executive	672 03	39 10	977 30		1,688 43
Exhibits			1,250 00		1,250 00
Fish and game magazine		64 29			64 29
General office	1,952 93	462 29	14,658 66	187 93	17,261 81
Library	510 00	17 48	28 60	49 19	605 27
Property inspection	825 00	9 06	85 64		919 70
Total Administration	$4,355 12	$611 74	$17,261 40	$357 87	$22,586 13
Patrol and Law Enforcement:					
Cannery inspection	$3,071 63	$2 27	$282 74		$3,356 64
Executive	4,635 00	29 46	323 94		4,988 40
General office	1,650 00	198 55	117 08	$42 49	2,008 12
Junior natrol	960 00	49 52	47 75		1,057 27
Land patrol	54,601 99	3,559 02	13,823 64	2,695 24	74,679 89
Marine patrol	20,472 93	2,793 58	7,665 37	4,525 86	35,457 74
M. V. Bluefin galley			15 30		15 30
M. V.-N. B. Scofield galley		83 69	304 86		388 55
Pollution patrol	2,762 00	194 35	868 98	1 88	3,827 21
Total Patrol and Law Enforcement	$88,153 55	$6,910 44	$23,449 66	$7,265 47	$125,779 12
Marine Fisheries:					
Central Valley Water Project Study	$1,616 44	$219 92	$691 20		$2,527 56
Executive	870 00	17 14	102 13		989 27
Field supervision	870 00	37 96	157 20		1,065 16
Fish cannery auditing			680 96		680 96
General office	2,730 00	192 76	126 87		3,049 63
Research and statistics	14,495 45	948 74	2,262 67	$471 08	18,177 94
Total Marine Fisheries	$20,581 89	$1,416 52	$4,021 03	$471 08	$26,490 52
Fish Conservation:					
Biological survey	$3,308 33	$872 37	$367 77	$203 20	$4,751 67
Executive	1,763 01	24 21	334 82		2,122 04
Field supervision	735 00	45 86	190 07	10 48	981 41
Fish food unallocated		1,415 34	466 00		1,881 34
Fish planting	2,021 72	322 01	844 75	812 26	4,000 74
Fish rescue	3,988 74	212 72	1,172 91	18 23	5,392 60
General office	1,740 00	60 13	89 21	14 20	1,903 54
Pollution inspection	870 00	7 81	127 33		1,005 14
Statistical	630 00	3 92	263 28		897 20
Stream improvements			1 68		1 68
Structural maintenance	928 55	11 28	414 58		1,354 41
Alpine Hatchery	1,030 00	489 22	72 15	8 17	1,599 54
Arrowhead Lake Egg Collecting Station	1,322 90	84 35	262 75	3 59	1,673 59
Basin Creek Hatchery	1,270 64	156 79	217 68	8 59	1,653 70
Bear Lake Egg Collecting Station	160 00				160 00
Benbow Dam Experimental Station	170 00				170 00
Big Creek Hatchery		9 47	—1 05		8 42
Brookdale Hatchery	1,170 00	204 18	199 19		1,573 37
Burney Creek Hatchery	1,981 01	59 85	93 44		2,134 30
Central Valleys Hatchery	765 00	60 51	325 42	14 42	1,165 35
Experimental Hatchery	300 00				300 00
Fall Creek Hatchery	1,616 47	37 69	40 51	52 49	1,747 16
Feather River Hatchery	1,320 00	555 18	215 35		2,090 53
Fern Creek Hatchery	870 00	100 11	42 88		1,012 99
Fillmore Experimental Station	520 00	15 16	130 69		665 85
Forest Home Hatchery	1,654 52	657 70	413 95		2,726 17
Fort Seward Hatchery	884 81	26 44	65 13	40 40	1,016 78
Heenan Lake Egg Collecting Station		17 34		5 05	22 39
Hot Creek Hatchery	1,679 19	348 43	316 53		2,344 15
Huntington Lake Hatchery	850 64	51 47	244 34		1,146 45
Kaweah Hatchery	1,165 81	38 57	339 84		1,544 22
Kernville Rearing Ponds	242 33	13 50	219 33		475 16
King Salmon Experimental Station		1 06	21 50		22 56
Kings River Hatchery	1,105 17	7 95	147 36		1,260 48
Kirman Lake Egg Collecting Station		14 53			14 53
Klamathon Egg Collecting Station	517 25	108 92			626 17
Lake Almanor Hatchery	1,779 68	86 61	148 25	78 53	2,093 07
Madera Hatchery	280 00	85 72	389 96		755 68
Mt. Shasta Hatchery	10,151 27	4,679 02	1,122 98	30 99	15,984 26
Mt. Tallac Hatchery	1,014 00	639 17	80 43		1,733 60
Mt. Whitney Hatchery	4,281 82	502 20	593 77		5,377 79

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1940, to September 30, 1940, of the 92d Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish Conservation—Continued					
Prairie Creek Hatchery	$1,610 00	$213 72	$173 05		$1,996 77
Rearing Reservoir			10 00		10 00
Scott Creek Egg Collecting Station	480 00	22 86	82 41		585 27
Sequoia Experimental Station	560 00		111 10		671 10
Shasta River Egg Collecting Station	170 33		6 90		177 23
Snow Mt. Egg Collecting Station	672 00	9 53			681 53
Tahoe Hatchery	2,217 12	411 53	288 98		2,917 63
Waddell Creek Station	420 00		4 44		424 44
Yosemite Hatchery	1,473 22	310 36	163 69		1,947 27
Yuba River Hatchery	930 00	55 87	41 99		1,027 86
Total Fish Conservation	$62,620 53	$13,050 66	$10,857 34	$1,300 60	$87,829 13
Engineering:					
Engineering	$2,925 32	$140 63	$809 72	$35 63	$3,911 30
Executive	1,080 00	68 29	198 17		1,346 46
Fish screens	349 20	25 13	48 65		422 98
General office	356 54	3 07	11 23	4 35	375 19
Total Engineering	$4,711 06	$237 12	$1,067 77	$39 98	$6,055 93
Game Conservation:					
Duck rescue	$240 00	$15 33	$337 83	$3 72	$596 88
Elk refuge	450 00	15 73	93 85		559 58
Executive	2,310 00	69 20	436 93		2,816 13
Game management	3,515 81	218 54	744 57	990 56	5,469 48
General office	825 00	10 79	277 90	60 40	1,174 09
Grey Lodge Refuge	1,230 00	149 55	9 31	10 03	1,398 89
Imperial Refuge	588 39		80 09		668 48
Los Banos Refuge	1,170 00	170 37	128 33	1,517 73	2,986 43
Predatory animal lion hunting	1,530 00	77 41	1,819 50	750 81	4,177 72
Predatory animal trapping	8,268 00	796 83	1,318 05	1,799 26	12,182 14
Research	2,141 94	134 50	603 51	123 70	3,003 65
Statistics	568 50		194 00		762 50
Suisun Refuge	928 50	218 78	95 22	4 04	1,246 54
Total Game Conservation	$23,766 14	$1,877 03	$6,139 09	$5,260 25	$37,042 51
Game Farms:					
Executive	$960 00		$14 15		$974 15
Game bird distribution—					
Los Serranos	620 00	$67 05	457 59		1,144 64
Yountville	3,113 87	118 15	868 03		4,100 05
Game management	110 00		27 00		137 00
General office	255 00		2 60		257 60
Los Serranos Boarding House			7 41		7 41
Los Serranos Game Farm	3,635 58	287 13	975 11		4,897 82
Yountville Boarding House	356 72	50 40	30 29		437 41
Yountville Game Farm	3,794 56	1,536 61	640 31	109 83	6,081 31
Total Game Farms	$12,845 73	$2,059 34	$3,022 49	$109 83	$18,037 39
Licenses:					
Executive	$915 00	$1 50	$26 50		$943 00
General office	390 00	1 37	198 72	$113 54	703 63
License distribution	3,909 14	274 28	22,244 55	17 00	26,444 97
Total Licenses	$5,214 14	$277 15	$22,469 77	$130 54	$28,091 60
Other Current Expenses:					
Fish screens—all objects					$12,986 24
Total Operating Expenses, 92d fiscal year					$364,898 57
Less estimated maintenance deductions					2,846 22
Net total 92d fiscal year expenditures					$362,052 35
Prior year 91st for support not closed					38,486 40
Totals 91st and 92d fiscal years operating expenditures					$400,538 75

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1940, to September 30, 1940, of the 92d Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Additions and Betterments:					
Improvements all projects, purchase of game refuges and public shooting grounds and construction, improvements and equipment	$4,374 02	$2,780 19	$107 40	$1,463 50	$8,725 11
Prior year 91st purchase of game refuges and public shooting grounds and C. I. E., all objects, all projects					1,750 92
Total additions and betterments, 91st and 92d fiscal years					$10,476 03
Special Item:					
Wild life restoration "Pittman-Robertson Act" in cooperation with federal government, 92d fiscal year					$7,210 45
Prior year 91st, wild life restoration, etc.					290 47
Total 91st and 92d fiscal years special item cooperation with federal government (see budget allotment ledger statement for detail)					$7,500 92
Contributions to Employees Retirement System, System, 92d fiscal year					5,512 59
Total expenditures, 91st and 92d fiscal years					$424,028 29
Prior biennium:					
Prior year, 90th, for support not closed					—$3 00
Prior year, 89th, for support not closed					3 37
Total, prior biennium					$0 37
Grand total, Fish and Game Preservation Fund					$424,028 66

GAME CASES

July, August and September, 1940

Offense	Number arrests	Fines imposed	Jail sentences (days)
Avocets: Possession	2	$20 00	
Bear: Closed season	5	135 00	
Deer: Deer meat, closed season, sale of deer meat, possess spotted fawn, spike buck, female deer, spotlighting, killing a doe, failure to fill out deer tags, fail to have tags validated, fail to produce hide and antlers on demand	193	6,007 50	560
Doves: Closed season, shoot from auto, no license	78	1,914 00	103
Ducks: Closed season, shoot from auto, no license	5	100 00	80
Firearms: In refuge	46	1,201 00	
Frogs: Undersized	2	30 00	
Game birds: Bring into California without permit, no license	9	285 00	
Hunting: No license, closed season	29	455 00	15
Light and gun: Possess in deer district	3		
Meadowlark: Kill and possess	1	25 00	
Night shooting	5	20 00	2½
Night hunting	18	340 00	125
Pheasants: Possess hen, closed season	35	1,020 00	507
Quail: Closed season, trapping valley quail	21	727 50	5
Rabbits: No license, closed season, shoot from auto	18	214 50	10
Sagehens: Bring illegally into the State	4	160 00	
Shoot: Non-game birds from auto, from road	7	110 00	
Shorebirds	3	175 00	
Squirrels: Killing tree squirrels	1	50 00	
Traps: Disturbing traps of a licensed trapper	1	10 00	
Totals	486	$12,999 50	1,407½

FISH CASES

July, August and September, 1940

Offense	Number arrests	Fines imposed	Jail sentences (days)
Abalones: Taking undersized red, overlimit, take from shells below high water mark, no license	20	$557 50	22
Angling: No license, closed season, with another's license, with set line, make false statement to secure license, fail show license on demand	89	885 00	10
Bass, black: No license, undersized, overlimit	12	80 00	87½
Bass, sea: Possession undersized, overlimit	3	50 00	
Bass, striped: No license, at night, undersized, with two rods	110	2,020 00	92
Catfish: Closed season	1	25 00	
Clams: Undersized Pismos, overlimit Washington, closed season, no license, razor clams, no license	31	755 00	50
Cockles, rock: No license	3	15 00	
Commercial fishing: No license	51	875 00	
Crabs: Undersized	2	25 00	
Crappie: No license, overlimit	2	35 00	
Explosives: Use to take fish in the Pit River	4	100 00	100
Fishing: Within two miles of the mouth of Blue Lake, within 300 ft. of the mouth of Wood Creek, within 150 ft. of the lower side of a dam	6	80 00	
Fish trap: In the waters of Latham Slough	1	10 00	
Gill net: Meshes larger than 1¾ inches, in boat district No. 2	5	100 00	730
Halibut: No license	1	25 00	
Lobsters: Closed season	1		
Minnows: Selling, no license	1	10 00	
Mussels: Take in San Diego Marine Life Refuge	1	25 00	
Net: In closed district	3	125 00	
Obstruction: Placing in a stream	1	100 00	
Pollution	17	3,850 00	
Refuge: Take fish in refuge	1	10 00	
Refuse to show fish on demand	5	20 00	
Salmon: Overlimit, no license	7	100 00	
Set lines: In District 1, in Whiskey Slough, in District 4¾	4	60 00	50
Spear: Within 300 ft. of the Trinity River	2	20 00	
Sunfish: Overlimit	2	25 00	
Taking fish in a closed area with ring net	18	1,600 00	
Trout: Closed season, no license, within 2-mile limit on Blackwood Creek, overlimit, closed area, closed stream, take by explosives	28	522 50	
Totals	432	$12,105 00	1,141½

SEIZURES OF FISH AND GAME

July, August and September, 1940

Fish and shellfish:	
Abalones, black	16
Abalones, red	275
Barracuda, pounds	107
Bass, black	14
Bass, large-mouthed black	2
Bass, striped	281
Bass, White sea-bass, pounds	18
Clams, Pismo	1,095
Clams, razor, sacks	10
Cockles	376
Crappie	16
Halibut, pounds	506
Lobsters	12
Lobster traps	7
Mussels, pounds	400
Salmon, silver, pounds	20
Sunfish	31
Sunfish, bluegill	15
Trout	31
Trout, pounds	3¼
Trout, eastern brook	37
Trout, rainbow	83
Trout, steelhead	6
Tuna, bluefin, pounds	431
Tuna, yellowfin, pounds	470
Game:	
Bear, steaks	4
Deer, doe	5
Deer, forked horn	1
Deer, spike buck	7
Deer, spotted fawn	1
Deer meat, pounds	3,397½
Doves	682
Ducks	52
Ducks, mallard	4
Ducks, sprig	1
Frogs	11
Kingfisher	1
Meadowlark	4
Pheasants	48
Pheasants, Chinese	6
Quail	10
Quail, mountain	1
Quail, valley	13
Rabbits, brush	3
Rabbits, cottontail	25
Rabbits, jack	10
Sagehens	37

SHIPMENTS OF FRESH FISH FROM OTHER STATES AND FOREIGN COUNTRIES

July, 1940

	Oregon and Washington	South of International Boundary	Japan
For canneries:			
Tuna, Albacore	46,852		576,934
For fresh fish markets:*			
Corbina, Mexican		220	
Sea-bass, Totuava		68,534	
Total pounds	46,852	68,754	576,934

August, 1940

	Oregon and Washington	South of International Boundary	Japan
For canneries:			
Tuna, Albacore	828,324		427,568
Tuna, Yellowfin		138,309	
For fresh fish markets:*			
Sea-bass, Totuava		8,447	
Total pounds	828,324	146,756	427,568

September, 1940

	Oregon and Washington	South of International Boundary	Japan
For canneries:			
Tuna, Albacore	714,923		351,974
For fresh fish markets:*			
Corbina, Mexican		1,994	
Crustacean:			
Shrimp		12,357	
Total pounds	714,923	14,351	351,974

* This record includes only that fish which is voluntarily reported to the Division of Fish and Game and does not represent all shipments.

COMMERCIAL FISH LANDINGS IN CALIFORNIA BY FISHING BOATS

July, 1940

Compiled by the Division of Fish and Game, Bureau of Marine Fisheries

Species	California waters								Oregon and Washington waters	Waters south international boundary		Total landings by fishing boats
	*Del Norte and Eureka Region	Sacramento Region	San Francisco Region	Monterey Region	Santa Barbara Region	Los Angeles Region	San Diego Region	Total pounds	Del Norte and Eureka Region	Los Angeles Region	San Diego Region	
Anchovy						157,072		157,072				157,072
Barracuda					1,565	265,990	116,877	384,432			15	384,447
Cabezone				270	80			350				350
Cabrilla											8,035	8,035
Catfish		2,205						2,205				2,205
Cultus, Pacific	33,484		12,550	6,364	41	10		52,449	600			53,049
Flounder, Starry	69,825		27,040	326	58			97,249	260			97,509
Flying Fish						9,710		9,710				9,710
Grouper											13,815	13,815
Hake	250		1,920					2,170				2,170
Halibut, California			3,740	1,508	38,331	16,038	290	59,907			8,429	68,336
Halibut, Northern	42,189							42,189				42,189
Kingfish			897	6,561	25	21,983		29,466				29,466
Mackerel, Horse				23,532		55,536	10,659	89,727				89,727
Mackerel, Pacific			18	14,184	1,119	550,818	1,843,946	2,410,085			700	2,410,785
Mullet							539	539				539
Perch			1,470	2,952	178	2,352	108	7,060				7,060
Pompano, California				2		4		6				6
Rock Bass					4,250	26,824	14,818	45,892				45,892
Rockfish	82,566		27,093	164,333	19,807	12,633	16,975	323,407			1,509	324,916
Sablefish	134,506		3,294	10,329	150	2,000		150,279				150,279
Salmon	779,954		275,418	71,905				1,127,277	356			1,127,633
Sand Dab	45,350		31,442	5,868		240		82,900	460			83,360
Sardine				154,998	793	89,548	1,470	246,809				246,809
Sculpin						11,126		11,126				11,126
Sea-bass, Black					985	5,413	376	6,774		21,104	35,210	63,088
Sea-bass, White			85	474	25,562	67,458	32,384	125,963			9,843	135,806
Shark	1,473		286,726	23,568	97,859	52,293	63,479	525,398		17		525,415
Sheepshead					711	775		1,486			63	1,549
Skate	1,485		5,741	401	1,088	296		9,011				9,011
Smelt	6,843		5,867	13,786	618	6,295	2,900	36,309			16	36,325
Sole	341,217		230,160	13,735	8,652	1,025	12	594,801	39,715			634,516

Swordfish, Broadbill					39,495	79,111	26,471	145,077		1,209	3,556	149,842
Tomcod	350							350				350
Tuna, Albacore			105		135	87,612	2,489	90,341				90,341
Tuna, Bluefin						1,749,029	151,243	1,900,272		153,861	3,500	2,057,633
Tuna, Bonito					7	50,685	132,284	182,976		187,494	206	370,676
Tuna, Skipjack										2,951,243	2,761,742	5,712,985
Tuna, Yellowfin						8,445		8,445		7,649,571	8,478,826	16,136,842
Turbot			4,550	112				4,662				4,662
Whitebait	9,439		2,825					12,264				12,264
Whitefish, Ocean					928	292		1,220				1,220
Yellowtail					15	8,988	9,556	18,559		309,937	147,931	476,427
Miscellaneous Fish	15,336		4,901	142	1,631	3,164	103	25,277	1,660			26,937
Crustacean:												
Crab	154,950		402,260	614				557,824	744			558,568
Crab, Rock						389		389				389
Shrimp			264,891					264,891				264,891
Mollusk:												
Abalone				143,750	84,275			228,025				228,025
Clam, Cockle			46			2,315		2,361				2,361
Clam, Gaper			220					220				220
Clam, Pismo					18,126			18,126				18,126
Clam, Soft-shell	36		5,123					5,159				5,159
Clam, Washington			88					88				88
Octopus	68		245	4,428				4,741				4,741
Oyster, Eastern			5,009					5,009				5,009
Oyster, Japanese			55,505					55,505				55,505
Oyster, Native			4,078					4,078				4,078
Squid				179,520				179,520				179,520
Total pounds	1,719,321	2,205	1,663,307	843,662	346,484	3,345,469	2,426,979	10,347,427	43,795	11,274,436	11,473,396	33,139,054

* The geographical regions of the State are as follows:
Del Norte and Eureka Region: Del Norte, Humboldt and Mendocino counties.
Sacramento Region: Sacramento and San Joaquin river systems with the delta areas, including Suisun Bay and Lake County.
San Francisco Region: Sonoma, Marin, San Francisco and San Mateo counties, including San Francisco and San Pablo bays.
Monterey Region: Santa Cruz and Monterey counties.
Santa Barbara Region: San Luis Obispo, Santa Barbara and Ventura counties.
Los Angeles Region: Los Angeles and Orange counties.
San Diego Region: San Diego and Imperial counties.
These tables are subject to slight revision due to belated supplemental items.

COMMERCIAL FISH LANDINGS IN CALIFORNIA BY FISHING BOATS

August, 1940

Compiled by the Division of Fish and Game, Bureau of Marine Fisheries

Species	California waters								Oregon and Washington waters		Waters south international boundary		Total landings by fishing boats
	*Del Norte and Eureka Region	Sacramento Region	San Francisco Region	Monterey Region	Santa Barbara Region	Los Angeles Region	San Diego Region	Total pounds	Del Norte and Eureka Region	San Diego Region	Los Angeles Region	San Diego Region	
Anchovy				100		693,889		693,989					693,989
Barracuda					332	198,541	86,286	285,159				969	286,128
Cabezone				422	164			586					586
Carp		15						15					15
Catfish		2,668						2,668					2,668
Cultus, Pacific	47,705		8,966	5,101	78			61,850					61,850
Flounder, Starry	17,198		21,573	47				38,818					38,818
Flying Fish						9,739		9,739					9,739
Hake	1,350		880					2,230					2,230
Halibut, California			10,555	1,578	44,874	5,955	4,372	67,334				23,366	90,700
Halibut, Northern	4,076							4,076					4,076
Kingfish			232	4,393	30	15,889		20,544					20,544
Mackerel, Horse				11,538		299,771	615	311,924					311,924
Mackerel, Pacific			180	45,498	441	4,051,317	657,201	4,754,637					4,754,637
Mullet							590	590					590
Perch			883	2,030	228	1,494	90	4,725					4,725
Pompano, California						61		61					61
Rock Bass					2,306	16,641	14,339	33,286					33,286
Rockfish	30,664		17,007	106,117	14,955	7,186	2,767	178,696					178,696
Sablefish	43,276		1,764	3,217	20	2,109		50,386					50,386
Salmon	1,476,991	137,645	553,468					2,168,104	223				2,168,327
Sand Dab	44,371		22,873	6,338		322		73,904					73,904
Sardine			3,718,000	183,496	840	52,727	983	3,956,046					3,956,046
Sculpin					12	10,542	60	10,614					10,614
Sea-bass, Black					826	2,587	762	4,175					4,175
Sea-bass, White			1,993	71,186	50,843	181,666	21,139	326,827			81,573	252	86,000
Shark	7 651		525,694	83,444	7,807	13,632	6,476	644,704				35,789	362,616
Sheepshead					1,116	308		1,424				208	644,912
Skate	1,825		9,245	1,011	2,190	662		14,933				106	1,530
Smelt	4,825		6,077	9,458	358	9,114	1,360	31,192					14,933
Sole	365,540		232,321	1,466	9,509	1,225	9	610,070	4,000			244	31,436
Split-tail		383						383					614,070
													383

Swordfish, Broadbill					105,991	140,231	51,764	297,986				30,813	328,799
Tomcod	260							260					260
Tuna, Albacore	215		2,265	205,457	197,870	106,950	126,912	639,669		12,350		880	652,899
Tuna, Bluefin				2,477	3,110	4,343,946	702,994	5,052,527			121,110	1,248	5,174,885
Tuna, Bonito					344	417,408	138,783	556,535			621,967	15,343	1,193,845
Tuna, Skipjack					281	3,747	167,496	171,524			4,198,881	5,739,866	10,110,271
Tuna, Yellowfin						51,538	72,980	124,518			2,643,376	7,459,552	10,227,446
Turbot			6,731					6,731					6,731
Whitebait	5,289		50					5,339					5,339
Whitefish, Ocean					397	324		721					721
Yellowtail						4,309	12,725	17,034			2,200,544	493,101	2,710,679
Miscellaneous Fish	8,945		5,129	30	1,009	1,169		16,282	400		110		16,792
Crustacean:													
Crab	64,580		280,914	60				345,554	48				345,602
Crab, Rock						160		160					160
Shrimp			192,778	7				192,785					192,785
Mollusk:													
Abalone				93,800	39,125			132,925					132,925
Clam, Cockle			36			162		198					198
Clam, Gaper			260					260					260
Clam, Pismo					16,229			16,229					16,229
Clam, Soft-shell	12		5,744					5,756					5,756
Clam, Washington			104					104					104
Octopus	12		259	974				1,245					1,245
Oyster, Eastern			5,975					5,975					5,975
Oyster, Japanese			65,139					65,139					65,139
Oyster, Native			2,093					2,093					2,093
Squid				40,330		2,675		43,005					43,005
Total pounds	2,124,785	140,711	5,699,188	879,575	501,285	10,647,996	2,070,703	22,064,243	4,671	12,350	9,867,561	13,801,737	45,750,562

* See footnote to table for July.

COMMERCIAL FISH LANDINGS IN CALIFORNIA BY FISHING BOATS

September, 1940

Compiled by the Division of Fish and Game, Bureau of Marine Fisheries

Species	California waters								Oregon and Washington waters		Waters south international boundary		Total landings by fishing boats
	*Del Norte and Eureka Region	Sacramento Region	San Francisco Region	Monterey Region	Santa Barbara Region	Los Angeles Region	San Diego Region	Total pounds	Del Norte and Eureka Region	Los Angeles and San Diego Regions	Los Angeles Region	San Diego Region	
Anchovy				1,290		678,916		680,206					680,206
Barracuda					21,091	33,952	13,505	68,548			70,140	28,777	167,465
Cabezone	92							92					92
Carp		126						126					126
Catfish		17,553						17,553					17,553
Cultus, Pacific	27,878		20,502	2,519				50,899	450				51,349
Flounder, Starry	8,460		22,512	381	34			31,387					31,387
Flying Fish						3,156		3,156					3,156
Hake	1,650		468					2,118					2,118
Halibut, California			2,842	2,632	43,137	4,968	19,378	72,957				11,956	84,913
Halibut, Northern	7,363		478					7,841					7,841
Kingfish			548	877		32,762	160	34,347					34,347
Mackerel, Horse				22,558		233,353		255,911					255,911
Mackerel, Pacific			400	64,379	6,228	8,824,340	58,877	8,954,224					8,954,224
Mullet							515	515					515
Perch			922	170	169	1,364	1,754	4,379					4,379
Pompano, California				409	1,582	21		2,012				86	2,098
Rock Bass					737	4,636	4,668	10,041				916	10,957
Rockfish	23,931		26,502	65,097	11,667	13,953	2,363	143,513				823	144,336
Sablefish	31,673		6,514	4,045		1,134		43,366					43,366
Salmon	373,564	687,559	2,820					1,063,943					1,063,943
Sand Dab	19,995		25,573	2,857		226		48,651					48,651
Sardine	65		6,430,653	38,463		354,715	260	6,824,156				200	6,824,356
Sculpin						5,951	294	6,245					6,245
Sea-bass, Black					44	841	20	905			60,538	1,356	62,799
Sea-bass, White			9,505	51,125	19,944	10,828	8,156	99,558			587	14,571	114,716
Shark	208,874		1,332,763	118,010	10,770	8,424	4,705	1,683,546					1,683,546
Sheepshead					46	262	85	393				768	1,161
Skate	2,820		8,590	1,273	2,332	275		15,290					15,290
Smelt	3,341		4,920	16,681	116	15,062	3,246	43,366				798	44,164
Sole	274,563		266,354	837	6,817	544	9	549,124	4,375				553,499
Split-tail		1,751						1,751					1,751

Swordfish, Broadbill					104,359	95,276	31,032	230,667			626	20,727	252,020
Tomcod			540					540					540
Tuna, Albacore			39,601	588,355	870,631	3,307	25	1,501,919		1,540,154			3,042,073
Tuna, Bluefin				2,212	2,735	627,159	83,131	715,237				38,867	754,104
Tuna, Bonito					3,015	1,731,481	48	1,734,544			271,883	48,187	2,054,614
Tuna, Skipjack						12,077	1,015,177	1,027,254			1,802,993	5,004,030	7,834,277
Tuna, Yellowfin						51	38,257	38,308			2,145,011	5,418,146	7,601,465
Turbot	700		6,288					6,988					6,988
Whitebait	5,481		28					5,509					5,509
Whitefish, Ocean						158	42	200				603	803
Yellowtail					11	969	5,591	6,571			400,494	472,709	879,774
Miscellaneous Fish	5,905		11,143	514	498	1,522	70	19,652					19,652
Crustacean:													
Crab	1,368							1,368					1,368
Shrimp			84,740					84,740					84,740
Mollusk:													
Abalone				123,200	19,650	50		142,900					142,900
Clam, Cockle			40					40					40
Clam, Gaper			240					240					240
Clam, Pismo					11,297			11,297					11,297
Clam, Soft-shell	24		6,766					6,790					6,790
Clam, Washington	3,016		96					3,112					3,112
Octopus	158		132	1,178				1,468					1,468
Oyster, Eastern			9,567					9,567					9,567
Oyster, Japanese			99,238					99,238					99,238
Oyster, Native			1,510					1,510					1,510
Squid				29,505		2,003		31,508					31,508
Total pounds	1,000,921	706,989	8,422,795	1,138,567	1,136,910	12,703,736	1,291,368	26,401,286	4,825	1,540,154	4,752,272	11,063,520	43,762,057

* See footnote to table for July.

Albacore landings in Los Angeles and San Diego Regions from Oregon and Washington were: Los Angeles Region, 1,080,922 pounds; San Diego Region, 459,232 pounds.

Salmon landed in San Francisco Region was caught in District 12-B where salmon season is open during September.

94505 2-41 3800

BUREAU OF ENGINEERING

JOHN SPENCER, Chief---San Francisco
Clarence Elliger, Assistant Hydraulic Engineer---San Francisco
Byron Wittorff, Assistant---Red Bluff
Edward Hensley, Junior Engineering Aid---Siskiyou County
Samuel Kabakov, Junior Engineering Aid---San Francisco
Emmert Lippincott, Junior Engineering Aid---Siskiyou County

BUREAU OF LICENSES

H. R. DUNBAR, Chief---Sacramento
L. O'Leary, License Agent---Sacramento
O. Coleman, License Agent---San Francisco
R. Nickerson, License Agent---Los Angeles

D. H. BLOOD, Departmental Accounting Officer---Sacramento

BUREAU OF PATROL

E. L. MACAULAY, Chief of Patrol (absent on military leave)---San Francisco
L. F. CHAPPELL, Acting Chief of Patrol---San Francisco

CENTRAL DISTRICT (Headquarters, Sacramento)

C. S. Bauder, Inspector in Charge---Sacramento

Northern Division

A. A. Jordan, Captain---Redding
Jos. H. Sanders, Captain---Sacramento
A. H. Willard, Captain---Nevada City
E. O. Wraith, Captain---Susanville
L. E. Mercer, Warden, Butte County---Chico
Chester Ramsey, Warden, Butte County---Oroville
Taylor London, Warden, Colusa County---Colusa
Albert Sears, Warden, El Dorado County---Placerville
E. C. Vail, Warden, Glenn County---Willows
Jack Sawyer, Warden, Lassen County---Susanville
Don Davison, Warden, Modoc County---Alturas
Earl Hiscox, Warden, Nevada County---Nevada City
Wm. La Marr, Warden, Placer County---Tahoe City
Nelson Poole, Warden, Placer County---Auburn
E. J. Johnson, Warden, Plumas County---Quincy
George Shockley, Warden, Plumas County---Portola
J. W. Thornburg, Warden, Plumas County---Chester
H. S. Vary, Warden, Sacramento County---Sacramento
Eugene Durney, Warden, Sacramento County---Sacramento
Earl Caldwell, Warden, Shasta County---Burney
Chas. Love, Warden, Shasta County---Redding
Don Chipman, Warden, Siskiyou County---Dunsmuir
Brice Hammack, Warden, Siskiyou County---Yreka
Lewis Olive, Warden, Siskiyou County---Tule Lake
Fred R. Starr, Warden, Siskiyou County---Dorris
R. E. Tutt, Warden, Sierra County---Downieville
J. E. Hughes, Warden, Solano County---Dixon
A. Granstrom, Warden, Sutter County---Yuba City
R. W. Anderson, Warden, Tehama County---Red Bluff
Harold Erwick, Warden, Tehama County---Corning
C. L. Gourley, Warden, Trinity County---Weaverville
C. O. Fisher, Warden, Yolo County---Woodland
R. A. Tinnin, Warden, Yuba County---Browns Valley

Southern Division

S. R. Gilloon, Captain---Fresno
John O'Connell, Captain---Stockton
R. J. Little, Warden, Amador County---Pine Grove
L. R. Garrett, Warden, Calaveras County---Murphys
F. A. Bullard, Warden, Fresno County---Reedley
Paul Kehrer, Warden, Fresno County---Fresno
Lester Arnold, Warden, Kern County---Bakersfield
C. L. Brown, Warden, Kern County---Kernville
C. S. Donham, Warden, Kern County---Taft
Ray Ellis, Warden, Kings County---Hanford
H. E. Black, Warden, Madera County---Madera
Gilbert T. Davis, Warden, Mariposa County---Mariposa
Hilton Bergstrom, Warden, Merced County---Los Banos
M. S. Clark, Warden, Merced County---Merced
R. J. Bullard, Warden, San Joaquin County---Tracy
Wm. Hoppe, Warden, San Joaquin County---Lodi
Geo. Magladry, Warden, Stanislaus County---Modesto
W. I. Long, Warden, Tulare County---Visalia
Roswell Welch, Warden, Tulare County---Porterville
F. F. Johnston, Warden, Tuolumne County---Sonora